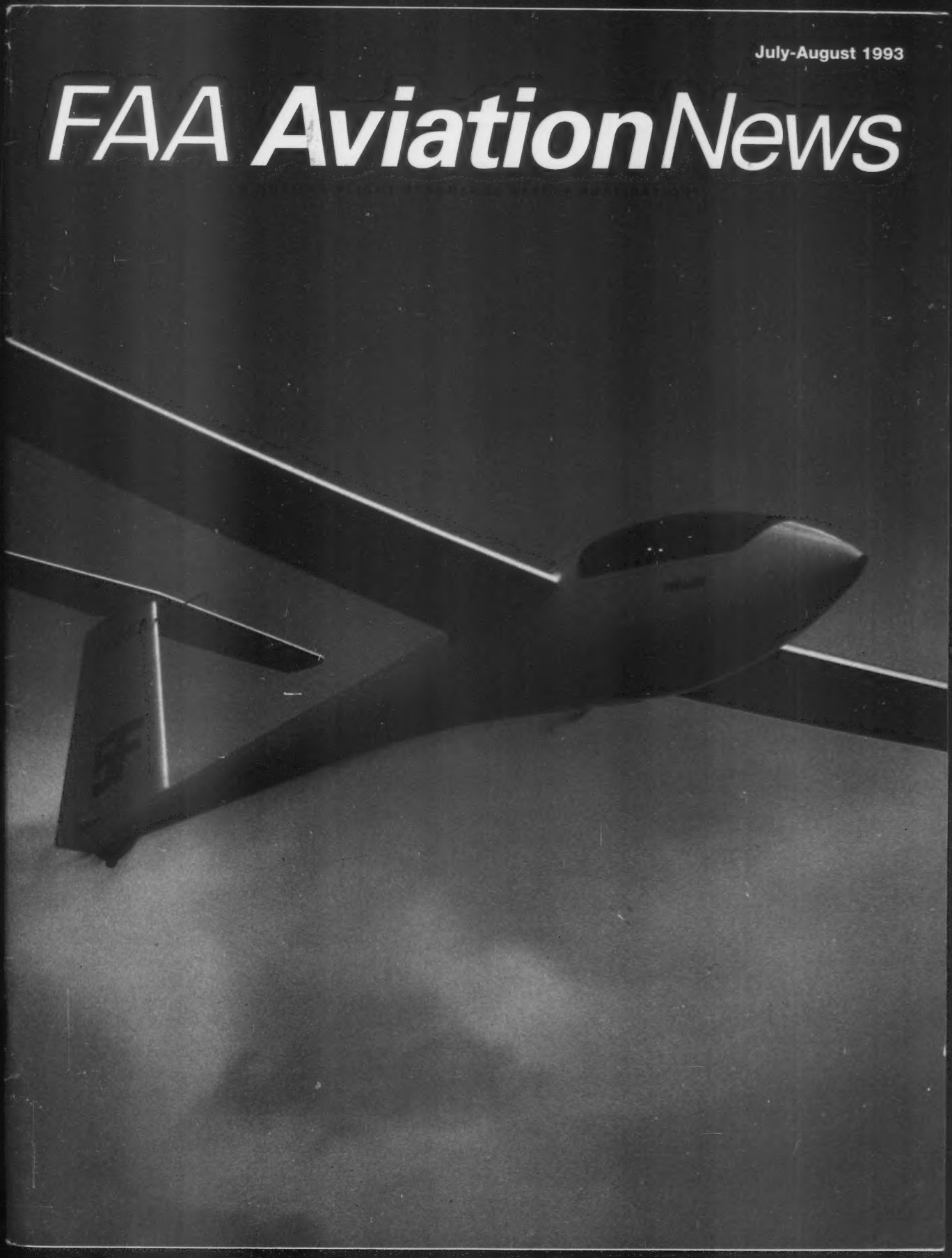
July-August 1993

FAA Aviation News



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FAA Aviation News

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Back Cover: *The FAA is into recycling. A tower that was dismantled, shipped cross country, and re-built now serves Manassas, VA. Photo by Kristine Kjos.*

Looking into General Aviation's Crystal Ball

by Phyllis Anne Duncan, *Editor*

There are a great many aviation soothsayers "out there" who are more than ready to predict there will be no more general aviation. They even attempt to put arbitrary dates for the demise—the year 2000 (which everybody uses now because we're so close; it really renders a prediction, well, predictable); 1995, the year where, if you've read the popular bestseller, the whole country will go bankrupt; there are even those who say any day now.

The cause? It usually comes down to no investment tax credit, tort reform, and "getting the FAA off our backs."

Needless to say, this made the Third Annual General Aviation Forecast Conference an interesting place to be.

For nearly two decades, FAA's Office of Aviation Policy, Plans, and Management Analysis (APO–110), has held conferences where it presents the results of its in-depth analysis of the aviation industry. The two-day event attracts hundreds of interested parties from the industry and many from the FAA itself. Three years ago—because general aviation was taking up so much of the agenda—APO–110 decided to hold a separate two-day meeting for general aviation. Its attendance has grown every year and is now a major event for the general aviation community.

This year the statistics contained in APO–110's conference booklet seemed to support the direst of the soothsayers' predictions. FAA expects the general aviation fleet to grow by less than 1% over the forecast period of Fiscal Years 1993–2004. That modest increase is driven primarily by growth in business use of general aviation aircraft. The number of hours flown should increase only gradually also—up 1.4% annually, reaching 35 million by 2004.

The brightest spot of the general aviation industry is rotorcraft. The active rotorcraft fleet should reach nearly 9,000 by 2004, with turbine powered rotorcraft (increasing by nearly 5% a year) comprising about 80% of the rotorcraft fleet. The number of overall rotorcraft hours flown should increase by over 6% a year; however, hours flown by turbine helicopters will increase 141% and reach over five million by 2004.

Helicopter Association International President Frank L. Jensen, Jr. echoed these predictions about what he termed aviation's "magic carpet." He expressed the need, however, for more heliports—especially in downtown areas—to service the growing helicopter industry.

Many speakers questioned FAA's predictions and offered their own statistics, which showed general aviation gravely ill, if not terminal. Indeed, speakers expended a great deal of time and talk about how bad things are but provided few solutions, with some exceptions. Two were notable.

Robert A. Wright

One was Dr. Bruce J. Holmes, Assistant Director for Aeronautics at NASA's Langley Research Center in Hampton, VA. The title of his presentation says it all—"U.S. General Aviation: The Ingredients for a Renaissance." The words "general aviation" and "renaissance" have rarely been used together lately, but Dr. Holmes and, apparently, NASA's Task Force see something the rest of the industry can't (or won't?). NASA has formed an Aeronautics Advisory Committee Task Force on General Aviation Transportation, which has been chartered to explore the various opportunities for general aviation of the future and to report its findings to NASA this fall.

The other was Robert A. Wright, Manager of the General Aviation and Commercial Division for the FAA, who offered one of the industry's few strategic plans to address the enhancement

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Piper Aircraft Corp.

Pilot Decision Making

by Tom Hamilton

Decision Making Process and Hazardous Attitudes

This is Part Two of a seven-part series that first appeared in Balloon Life *magazine in 1989 and was originally written for balloon pilots. We have left the lighter-than-air examples in because the overlying issue of pilot decision making affects all pilots.* ***—Editor***

As pilots we analyze the elements or risk—pilot, aircraft, environment, and operation—that make up a particular situation. By evaluating those elements of risk we decide on a course of action. In Part One of this series we defined this intellectual ability as the pilot's capability to sense, store, retrieve, and integrate information. In an ideal world the pilot would solve the problem much in the same manner as a computer.

This headwork is the intellectual process used to formulate decision making strategies. The necessary ingredients in good headwork are knowledge, vigilance, selective attention, risk identification and assessment, information processing, and problem solving ability. Headwork, when properly applied, minimizes the negative influence of attitudes and personality traits. The key then is for the pilot to separate the headwork aspect of decision making from the attitudinal part.

Effective headwork requires us as pilots to manage our attitudes, stress, risk, and crew. Those, combined with our skills and procedures—ability to fly the aircraft—results in our responding to a given situation. If our response is adequate, we have a successful operation. If it is inadequate, a mishap occurs.

In this article we will look at how we process information to achieve orderly, timely decision making. We will also look at managing attitude and the five hazardous attitudes to avoid.

Skills and Procedures

If you look at the situation flow chart (Figure 1) you will see that a change or event occurs. The pilot recognizes the change and selects a response using intellectual ability as well as airmanship ability. Airmanship is the procedural, psychomotor, and perceptual skills that are used to control the aircraft and its systems. These skills are learned during the conventional training process until they become automatic reactions. These skills are highly specific to the type of aircraft and are taught in traditional flight training programs using a variety of learning materials.

Decision Making

The traditional approach to pilot decision making has been to teach pilots the capabilities and flight characteristics of an aircraft and its systems, knowledge of the national airspace system, general knowledge of meteorology, regulations, emergency procedures, etc.—the premise being that, if pilots have this kind of information, they will be able to exercise the "good judgement" required to assure safe flight.

Decision making, however, is a mental process. In recent years decision making models have been developed to teach the pilot how to make good decisions. As a pilot considers an action, the consequences of taking, as well as not taking, that action must be considered carefully. To assist pilots in this process, the FAA and AOPA Air Safety Foundation developed a decision making training program based upon previous experience in researching the decision making process. The decision model consisted of 10 steps. For simplicity the model was reduced to a six-element decision process using the acronym DECIDE (Figure 2).

The six elements of the DECIDE model are a continuous loop decision process which has been used during accident analysis and during the instruction of pilots of varying experience levels.

Employing the six elements of the DECIDE model, a pilot uses his or her intellectual abilities and relies on these capabilities to sense, store, retrieve, and integrate information. Earlier we said that this part of judgement is purely rational, and if used alone, would allow problem solving in much the same manner as a computer.

Pilots aren't computers; they are people and are affected by motivations and attitudes. Thus, in part, pilot judgement is based on tendencies to use other than safety-related information when choosing courses of action. It is the management of attitudes, stress, risk, and crew that also play an important role in pilot decision making.

Managing Attitude

How a pilot handles his or her responsibilities as "pilot-in-command" depends to a large degree upon ingrained attitudes—toward safety, toward him- or herself, and toward flying. Attitudes are learned and are not innate behavior. Good attitudes can be developed—again, through training—into a positive mental framework that encourages and produces good pilot judgement. On the other hand, bad pilot thinking habits created by previously learned poor attitudes can be "unlearned" or modified through training.

Descriptions of five hazardous attitudes that each pilot needs to be aware of follow:

Anti-Authority—This is found in people who do not like anyone telling them what to do. They think, "Don't tell me!" In a sense, they are saying, "No one can tell me what to do." They may either be resentful of having someone tell them what to do or may just regard rules, regulations, and procedures as silly or unnecessary. However, it is always your prerogative to question authority if you feel it is in error.

Impulsivity—This is the thought pattern of people who frequently feel the need to do something, anything immediately—a type A personality. They do not stop to think about what they are about to do; they do not select the best alternative—they do the first thing that comes to mind, e.g., "Got to land!" A balloon pilot acting impulsively, for example, when confronted with powerlines at eye level in front of the balloon, might turn on the burner to try and fly over the lines rather than rip out.

Invulnerability—Many people feel that accidents happen to others but never to them. They know accidents

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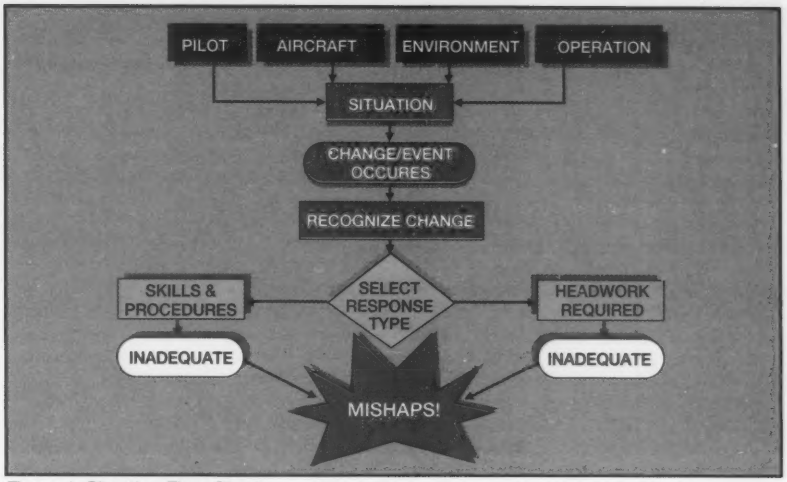


Figure 1 Situation Flow Chart

DETECT
The decision maker detects the fact that change has occurred.

ESTIMATE
The decision maker estimates the need to counter or react to change.

CHOOSE
The decision maker chooses a desirable outcome (in terms of success) for the flight.

IDENTIFY
The decision maker identifies actions which could successfully control the change.

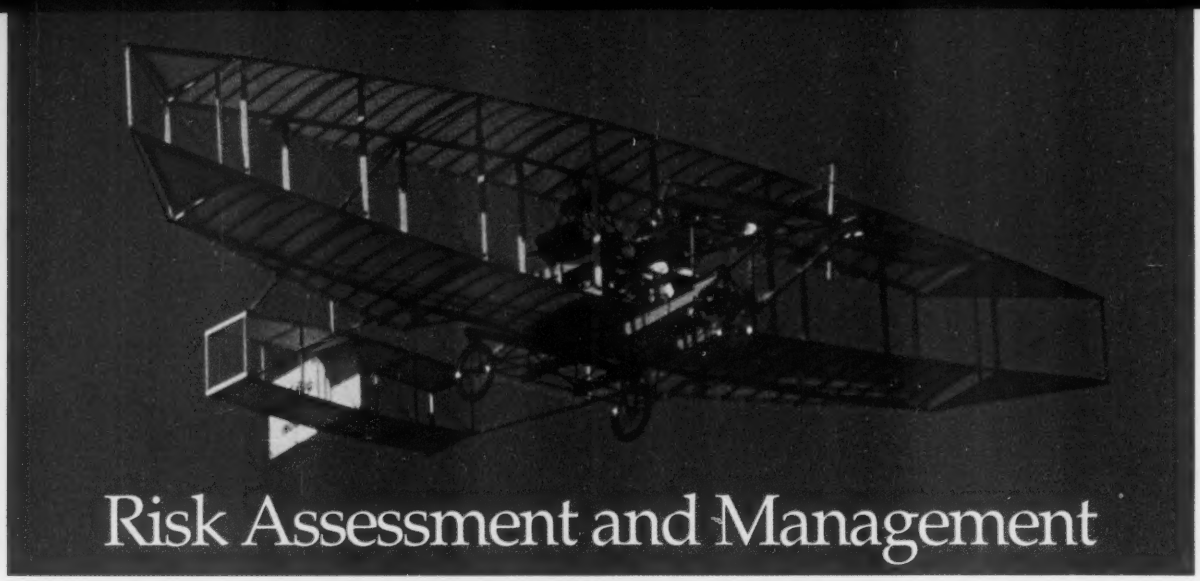
DO
The decision maker takes action to adapt to the change.

EVALUATE
The decision maker evaluates the effects of the action countering the change or reacting to it.

Figure 2 The six elements of DECIDE

Hazardous Attitude	ANTIDOTE
Anti-Authority *Don't tell me!*	Follow the rules. They are usually right.
Impulsivity *Do something quickly!*	Not so fast. Think first.
Invulnerability *It won't happen to me!*	It could happen to me. Think about the worst possible accident; it could happen to you.
Macho *I can do it!*	Taking chances is foolish.
Resignation *What's the use!*	I'm not helpless. I can make a difference.

Figure 3 How to avoid hazardous attitudes



Risk Assessment and Management

by Denney L. Bridges, *APPM, Helena, MT*

All activities that we endeavor to undertake involve risk. The more complex an activity becomes, the more opportunity there is for a failure or breakdown and, therefore, the greater the risk. The more an activity allows for "outside" influence, the higher the risk. Also, the greater the complexity of an activity, the more highly regulated that activity will tend to be. Aviation would seem to fall into this described hierarchy as a fairly complex, and therefore, risky activity.

We have been fairly successful in managing the risks associated with flying. We are continually learning from our mistakes as well as the mistakes of others. Our predecessors made mistakes in design, engineering, production, and flight tests. All of us in aviation have actually benefited from those mistakes. Our predecessors made errors, percentage wise, at a much greater rate than we do. That's why they were known as "pioneers." We should thank those pioneers for the heritage they have left with us.

Below are some accident statistics from the days of the pioneers:

Early Aviation Statistics

1903—First powered flight by the Wright Brothers

1904—Orville had the first wind shear accident

1908—First fatal air crash

1910—First mid-aid collision

1912—First pilot killed as a result of a bird strike

1914—France has 1,400 military air planes, Germany has 1,000, Great Britain 400, Russia 800, the United States 23; wartime losses are tremendous

1918—The U.S. Airmail Service is founded. The U.S. government operates this service for nine years. The airmail pilot's life expectancy is four years. Thirty-one of the first 40 pilots are killed before the Service is turned over to private industry. A forced landing occurs every 20 hours of flight. In the Airmail Service's history, one in every six pilots was killed in a flying accident while delivering the mail.

Currently, less than seven accidents (fatal and non-fatal) occur per 100,000 flying hours in general aviation. We have learned a lot from the pioneers, but we can improve our risk assessment and risk management skills even more. It's not a bad legacy to leave to the next generation of aviators.

Managing Risk

As pilots, we are taught from our first flying lesson how to manage the risks inherent to flight. We are made aware of a whole range of hazards that can easily be avoided and some that cannot. The system used to verify a pilot's ability to perform the tasks necessary to operate a given aircraft safely is based on that person's risk management skills. We evaluate this skill by developing scenarios in which an individual's *preparation, proficiency*, and *training* are tested and compared to established standards. These scenarios are the certification tests, flight reviews, and proficiency checks that all pilots must undergo.

All three of the elements of risk management are closely related, experience-driven, and equally important. The portion of risk management that is primarily involved with the assessment of how risky a particular event may be in the preparation phase. Preparation can be broken down into three major categories: *mental, physical*, and *mechanical*.

Each flight begins with an individual assessing his or her mental state. The most convenient method for a non-health professional to use is to evaluate his or her own attitudes. We must decide if we possess an attitude conducive to the safe completion of a planned flight. Consequently, the mental aspect of preflight planning should not be overlooked. How well flight planning is accomplished relates to training in many ways. It also reflects one's mental state.

At the same time we must determine if our physical condition is appropriate for flight.

The final element in the preparation phase involves the aircraft and its mechanical condition. The actual preflight of the aircraft, specifically the thoroughness of the inspection, and the pilot's ability to assess the observed condition of the aircraft correlate directly to the quality of that individual's training.

Proficiency vs. Currency

Proficiency is often confused with currency. A pilot who is legally current may not be as proficient as necessary for a given flight. The amount of current flying experience required to become proficient is as variable as the skill level of each individual who chooses to fly. Each flight that we begin also offers particular challenges unique to that flight. Therefore, we must realize that the proficiency level necessary to complete a flight successfully varies with the complexities or demands of that particular flight. A prudent pilot usually makes a subconscious analysis of the proficiency required for a specific flight. Accident prevention could be enhanced if a conscious effort were made to evaluate one's own ability before each flight (e.g., my instrument skills don't need to be so proficient for a day VFR flight as they might need to be if there is a chance of encountering weather).

Training

When pilots discuss the subject of flight training, the cost of such training usually becomes the focal point. If you think training is so expensive, just wait until you have to pay for an accident. Even with good insurance coverage, accidents are expensive and painful (in more ways than one) experiences. Training is the least expensive (in some cases the only) alternative to an accident.

Almost all professional pilots receive at least annual proficiency training, with one important exception—general aviation. The FAA's Pilot Proficiency Award Program was designed to encourage general aviation pilots to obtain some annual proficiency training. We believe that pilots who participate in this program have a lower accident rate than those who do not. Completion of any single phase of the "Wings" program also precludes accomplishing a biennial flight review.

Training is worth the expense. ■

Accident statistical data came from *Normal Accidents* by Charles Perrow (1984) and *FAA Statistical Handbook of Aviation* (1991).

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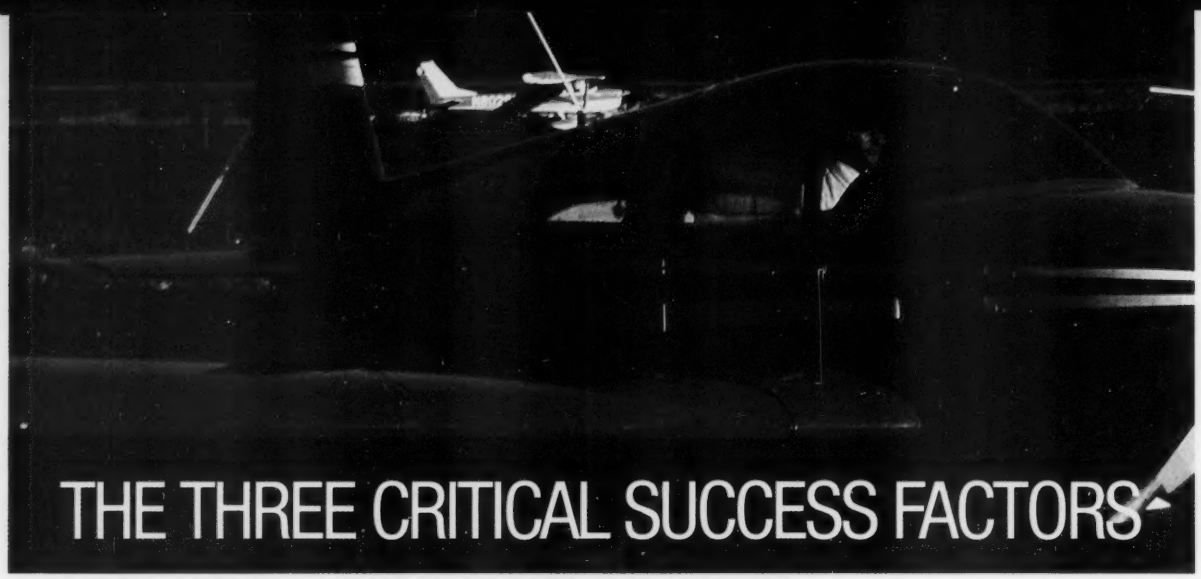


THE THREE CRITICAL SUCCESS FACTORS

by Larry Schuman, *SimuFlight Training International*

During my aviation career, I have observed pilots in training and line operations who have performed measurably better than others, notably during abnormal and emergency situations. Why is this? We all receive similar initial and recurrent training, simulator training, and checkrides. What, then, makes one pilot outperform another?

In general terms, well-trained aviation professionals share certain attributes and attitudes. These particular qualities are internal. Not only are they present during training, they are present at all times. While excellence in a training environment is no guarantee of excellence during a true emergency, pilots who display these three factors during training and normal line operations consistently display them during actual abnormal and emergency situations. These qualities are called the "Three Critical Success Factors."

1. An Intimate Knowledge of the Business

Professional pilots know much more than the minimum required to complete their training or a checkride. They spend time reviewing the *Airman's Information Manual* and are familiar with proper procedures and techniques for their aircraft and the ATC system. In addition, they have an exceptional understanding of the corporate culture, its policies, and procedures.

These same pilots are extremely resourceful. They are knowledgeable about the information available to them on enroute and approach charts. They understand the symbology. They know their aircraft and its performance capabilities. As "students" of aviation, they are never content with their present knowledge. They are continually searching for more.

However, these pilots are susceptible to making mistakes, but their mistakes are generally less serious and acknowledged in time to make the necessary correction.

What part, then, does the "intimate knowledge of the business" play in the day-to-day activities of the professional pilot? The answer is simple. When we are faced with a tough decision, the more knowledge we have about the specific subject, the better the outcome. The best decisions are made by those of us who know our jobs best. Simple, but critically important.

Three Critical Success Factors

1.
An Intimate Knowledge of the Business

2.
A Professional Attitude Embracing Continual Skepticism, Time-Dependent Situational Awareness, and the Conservative Response to Challenge

3.
The Development and Use of Standard Operating Procedures (SOP)

2. A Professional Attitude Embracing Continual Skepticism, Time-Dependent Situational Awareness, and the Conservative Response to Challenge

As professional pilots we must also be professional skeptics. We must not accept status quo for status quo changes quickly at jet speeds. The best among us are constantly alert and always asking ourselves, "What if. . . ?"

A "time-dependent situational awareness" is perhaps the most important of all three factors. The elements of "situational awareness" include knowing the airspeed, altitude, heading, next navigation waypoint, amount of fuel, and present location with regard to a ground reference point. The National Transportation Safety Board (NTSB) accident files include several fatalities where pilots lost situational awareness.

The final part of the second Critical Success Factor is the "Conservative Response to Challenge." A "challenge" is anything that occurs during a flight that compromises safety. For instance, a systems failure or a line of severe storms approach. The "Conservative Response" is any action taken that preserves or enhances our current level of safety.

3. The Development and Use of Standard Operating Procedures (SOP)

First, SOP's provide a structure for operations which gives crew members the ability to anticipate each other's actions. SOP's give us a standard for monitoring and enhance flight safety by keeping pilots "in the loop." Second, and perhaps more important, pilots don't like surprises. SOP's provide us with procedures to manage many situations. In short, SOP's help structure our long-term planning.

Long-term planning is any action taken for which there is an anticipated response. SOP's provide us those anticipated responses and procedures. Examples include the FAR, the Airplane Flight Manual, and company handbooks. Short-term planning is what the crew of UAL 232 at Sioux City, Iowa experienced when they lost all three hydraulic systems. They did not have an SOP for the loss of all hydraulic systems. Therefore, the crew had to create a set of procedures tailored to their immediate situation.

As professional pilots it is vital to be aware of and practice all three critical success factors—if we want to live through our careers. Reviewing NTSB reports and reading aviation statistics tell us that almost 80% of all aircraft accidents are caused by some type of human error. The difference, therefore, between excellent performance and "merely acceptable performance" is extremely critical to all of us. ■

Mr. Schuman is an Advanced Airmanship Instructor for SimuFlite. This article originally appeared in the Summer 1991 issue of SimuFlite's newsletter, Advanced Airmanship.

Looking into General Aviation's Crystal Ball

Continued from page 1

of general aviation. A task force of top-ranking industry organizations (the GAAP Coalition) has adopted the General Aviation Action Plan (GAAP) as the best hope for general aviation. The GAAP Coalition has formed four working groups (Accident Prevention, Training, Maintenance, and Technology) led by industry members and with FAA representation. The working groups will design programs that will ensure the future of general aviation and that support the goals and objectives of the GAAP. (For an overview of the GAAP, see the July/August 1992 *FAA Aviation News* Editorial.)

Both Dr. Holmes' and the GAAP's proposals are material for later articles; we can't do them justice here. You may contact Dr. Holmes at NASA Langley Research Center, Hampton, VA 23681–0001 concerning the Task Force's work and his strategies for general aviation. If you would like a copy of the General Aviation Action Plan, contact the FAA's General Aviation and Commercial Division, AFS-800, 800 Independence Avenue, SW., Washington, DC 20591; (202) 267–8212.

Both Dr. Holmes and Mr. Wright doused the "doomsayers'" flames at the Forecast Conference because they offered solutions and not merely complaints. General aviation will survive and will be viable, but it will take hard work and vision—not whining. ■

Pilot Decision Making

Continued from page 3

can happen, and they know that anyone can be affected; but they never really feel or believe that they will be the one involved. Pilots who think this way are more likely to take chances and run unwise risks, thinking all the time, "It won't happen to me!" Think of the worst accident that you can imagine, and then picture yourself in it.

Macho—People who are always trying to prove that they are better than anyone else think, "I can do it!" They "prove" themselves by taking risks and by trying to impress others. While this pattern is typically labeled as a male characteristic, women are equally susceptible.

Resignation—People who think, "What's the use?" do not see themselves as making a great deal of difference in what happens to them. When things go well, they think, "That's good luck." When things go badly, they attribute it to bad luck or feel that someone is "out to get them." They leave the action to others—for better or worse. Sometimes, such individuals will even go along with unreasonable requests just to be a "nice guy." These are people who can be talked into anything.

Antidotes for Hazardous Attitudes

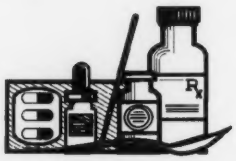
Being aware of the five hazardous attitudes makes you more alert to them in your own thinking. This is an important first step in eliminating them from your judgements.

In Figure 3 we have provided the antidotes for each of the hazardous attitudes. By telling yourself something different from the hazardous attitude, you're "taking an antidote" to counteract the hazardous attitude. You remove a hazardous thought by substituting the antidote. Recognize a hazardous attitude, correctly label the thought, and then say its antidote to yourself.

By being aware of the hazardous attitudes and applying the antidotes helps to manage or control your attitude and eliminate one of the elements that interferes with headwork during the pilot decision making process. ■

Next issue is Part 3—Managing Stress.

Medical Stuff



Adhesive Nicotine Patches Help Pilots Quit Smoking

In the March 1993 issue, we wrote about the physiological effects of smoking on flying, and maybe some pilots made the commitment to quit. What is the best way? Cold turkey? Hypnotism? Acupuncture? Studies indicate that sudden nicotine deprivation causes withdrawal symptoms that degrade pilot performance. However, the availability of new programs to help smokers quit the habit while reducing or minimizing withdrawal symptoms may be especially well-suited for flight crews. ***—Editor***

by Stanley R. Mohler, M.D.

As the detrimental health consequences of smoking become more widely understood, a record number of people worldwide are quitting the use of tobacco products. This change is especially reflected among professional pilots who have developed lifestyles to promote good health and career longevity. Some airlines will not hire a pilot who smokes, and other operators prohibit smoking on the flight deck. [In the U.S., the FAR prohibit smoking on U.S. domestic flights of under six hours, but smoking on the flight deck is permitted if the pilot-in-command authorizes it. Smoking on the flight deck is prohibited during takeoffs and landings.]

Tobacco use results in a powerful addiction to nicotine, which can trigger disturbing withdrawal symptoms. If cigarettes or other tobacco products are not available, addicted tobacco users often become irritable and restless, and they can experience difficulties in mental concentration along with generalized feelings of illness. Quitting tobacco use without some assistance is difficult and often unsuccessful. Relapses occur frequently.

A number of publications and programs provide specific guidance on how to quit smoking successfully. In addition there are audio cassette tapes that can assist smokers to quit. Various approaches have been developed to help those who are "hooked" and want to quit but who cannot stop smoking without assistance. There are now several transdermal nicotine delivery systems using skin-adhesive patches that can help the smoker move away from the lung-destroying inhalation of nicotine acquisition. More adhesive patch treatment systems can be expected in the future.

At least four companies have conducted research and perfected the use of transdermal nicotine delivery systems for sale in the U.S. These companies offer the products Nicoderm, Prostep, Habitrol, and Nicotrol, which are available by prescription. These systems are available under a physician's guidance, and their use can be tailored to a given person's needs.

Nicotine is absorbed rapidly by the skin, and about half of it is eliminated from the body in one and a half hours. The skin delivery system provides a target blood level of nicotine so that the individual who stops smoking will not experience (during the initial period of not smoking) the withdrawal symptoms that plague most tobacco smokers when they try to quit. This appears especially important for pilots who smoke.

What the Research Says

Research conducted by FAA's Civil Aeromedical Institute (CAMI) suggests that sudden nicotine withdrawal should be avoided on the flight deck. "For some, withdrawal symptoms including tension, depression, irritability, difficulty in concentration, decreased heart rate, a fall in blood pressure...and impaired performance may occur and more than offset any benefits to aviation safety that are expected from a ban on preflight and inflight smoking," concluded an FAA study on the effects of tobacco on aviation safety. The FAA study said it supported "smoking cessation programs and pharmacologic approaches to nicotine replacement... for improved health, performance, and safety." But the study recommended smoking cessation programs that minimized flight deck withdrawal symptoms. Nicotine patches would achieve that goal by reducing or eliminating withdrawal symptoms.

Another FAA study said experiments of complex pilot performance conducted at a simulated operational cabin altitude of 6,500 feet found "significant adverse effects of smoking withdrawal.... When smoking was permitted the overall index of performance was maintained at the initial level or higher over four hours of testing. When smoking was prohibited, however, performance declined with time. The effect was largely a decrement in tracking performance, a psychomotor function important to flying." The study concluded: "Although there were no significant differences between the performance of nondeprived smokers and nonsmokers, smokers who were deprived had significantly inferior tracking and vigilance performance."

A report prepared by the U.S. National Institutes of Health also found that the "fast decline of plasma nicotine and other effects of withdrawal in the habitual smoker are associated with decrements in vigilance and concentration and with increased irritability, anxiety, and aggression."

But that is not a reason to keep smoking.

In addition to identifying long-term health-damaging aspect of smoking, aeromedical studies have established a strong link between smoking and adverse performance effects in the cockpit. Carbon monoxide and nicotine from smoking are known to affect

altitude tolerance, vision, and certain judgement and psychomotor skills.

Withdrawal Patchwork

Recent research has shown that many persons find skin patches to be of benefit in getting through the withdrawal period following smoking cessation, which usually lasts two to four weeks. The patches are available in decreasing sizes. As the smoker gradually reduces nicotine addiction, smaller doses of nicotine can be delivered and still alleviate withdrawal symptoms. Symptoms alleviated by the adhesive patch nicotine delivery systems include concentration difficulty, irritability, general feeling of unease, agitation, and headache.

Once the patch is in place, the individual must not smoke. Smoking while wearing the patch would expose the body to a dangerously high dose of nicotine. Nicotine is a deadly poison in high doses. Similarly, nicotine chewing gum cannot be used while the patches are worn.

Studies indicate that smokers who use the patch plus a behavioral modification activity to quit smoking have a higher chance of success without a smoking relapse. It has also been found that after about two weeks of non-smoking and after phasing down with the nicotine patches over four to eight weeks, the individual ex-smoker will experience higher quality sleep, will need less sleep, will be more mentally alert, and will have more energy. In addition, the ex-smoker will have an enhanced sense of smell and taste and will thus use less salt on food, leading to a lower risk of hypertension.

Patch Use

When tobacco is smoked, each inhalation delivers nicotine into the lungs and then into the bloodstream where the nicotine is carried to the brain within eight seconds. The immediate result is to relieve any developing withdrawal symptoms. It creates a feeling of relief for the addicted person. The continual seeking of this relief is one of the causes of continued nicotine dependence and addiction. Patches deliver small, controlled doses of nicotine throughout a sustained period of time, thus working to offset the disturbing symptoms of withdrawal from nicotine.

One of the patch systems, for example, is applied once a day in accordance with the prescription, usually in the morning. The time of application can be varied based on individual preference and the agreement of the prescribing physician. However, the patch should be applied at the same time each day. Some of the patches can be worn while bathing in a tub or shower, while using a hot tub, or while swimming. These patches stick tightly. The user applies a given patch for only one 24-hour time period or for another period as prescribed. Only one patch can be worn at a time. Each patch is applied to some part of the upper body, upper arm, or upper back, and the location of the patches is varied from day to day. This variation is intended to avoid minor skin irritation that could develop by applying the patch in the same place day after day.

Directions that come with the patches tell how to discard them and also emphasize that patches must be kept away from small children and pets because any nicotine exposure would be too high for their body sizes. Pregnant women should be certain their physicians are aware they are pregnant. It is well-established that pregnant women who smoke can cause serious damage to the developing fetus.

Other Considerations

Services are also available that can provide both physical and emotional support during the withdrawal process. Support hotlines that can help an individual understand withdrawal problems are also very important. Such encouragement and assistance have been found to be helpful in preventing smoking relapses.

Persons who quit do not automatically gain weight. In fact, a significant number of persons who have quite do not put on weight. One way to avoid gaining weight is to engage in moderate exercise and to be moderate in food consumption, especially with respect to consuming sweets as a substitute for smoking.

As with any addiction, an approach that targets progress one day at a time is the most successful. Substitute hand actions must be learned to replace the fiddling with lighters, cigarettes, and other smoking materials and paraphernalia that characterize the smoker. Avoidance of alcohol is also an important consideration because it can cause ex-smokers to relapse through impaired judgement or prior association. Alcohol in small amounts can be consumed by ex-smokers without relapsing if the individual is vigilant against relapse tendencies.

Continued on page 16

Four Transdermal Patch Systems

	Nicoderm	Prostep	Habitrol	Nicotrol
Nicotine content (mg)	114 (22 sq. cm)	30 (7 sq. cm)	52.5 (30 sq. cm)	24.9 (30 sq. cm)
Dosage per time period	21mg/24h	22mg/24h	21mg/24h	15mg/16h
Duration of treatment	4–8 weeks	4–8 weeks	4–8 weeks	4–12 weeks

Note: Smaller sizes with lower nicotine doses are available for light smokers (less than one-half pack per day and for persons weighing less than 110 pounds (50KG).

Source: Stanley R. Mohler, M.D.

Aircraft Missing—Or Is It?

by H. Dean Chamberlain, *Associate Editor (and CAP member)*

We need your help.

Actually the U.S. Air Force Rescue Coordination Center (AFRCC) needs your help. Helping the AFRCC means you will also help yourself and other airmen. Helping won't cost you anything except a few seconds of your time, but it could save the Government money.

In these budget-cutting times, does this sound too good to be true?

This is one deal you can't afford to miss. You might even help save a life in the process—maybe even yours. Any way you look at it, it's a great deal.

If you have access to an aircraft frequency radio and about 10 seconds of time, you can do something to reduce excess Government expenditures. All you have to do is use your radio to check your own and neighboring aircraft for possible inadvertent ELT activation. This simple effort can help save the Government, and many dedicated volunteers, both money and time.

That's right. Ten seconds of your time can save the US Air Force (USAF) and others, most notably the Civil Air Patrol (CAP), the cost and time necessary to locate and turn off either your own or someone else's activated ELT that was accidentally (no pun intended) activated—ELT's that may be transmitting to the world their aircraft's' hard landings, bounces, and thumps.

FALSE ALARMS

According to a recent AFRCC activity report for Calendar Year 1992, the AFRCC, which is responsible for coordinating inland search and rescue (SAR) efforts, indicated that one of its biggest problems in 1992 was the high rate of false ELT signals. However, false ELT transmissions are one aviation statistic we could reduce to zero if we would all take just a few seconds to tune our aircraft radios to 121.5 MHz before securing our aircraft. (The (AIM), paragraph 6–15 contains suggested procedures for checking ELT's at shutdown. Some aircraft have expanded checklists that provide a similar procedure, but you could also adapt the AIM procedures for your own shutdown checklist.)

If you were to do this at shutdown and you heard the characteristically raucous ELT signal, that would be a good indication that your ELT, or one nearby, is transmitting. If it turns out to be your ELT transmitting, you should either turn the ELT off or disconnect its battery to verify it's your ELT, then notify the nearest ATC facility about the false signal. (If you turn off or disconnect your ELT, you must ensure that you comply with appropriate airworthiness requirements before your next flight.)

If the signal is not from your ELT, try to locate the transmitting ELT. It might be an emergency signal from an accident site just out of view, since many aircraft crash on or near airports. Probably, you will find just another false alarm. But the only way to tell a false alarm from an emergency is to locate the suspected ELT and turn it off. This is where all the time and effort come in, and this is why we could save the Air Force and everyone who has to go out and try to find a transmitting ELT a lot of work if we do an ELT final check before we secure our aircraft.

We would also help *those in distress* by not tying up valuable resources looking for false alarms. A final ELT shutdown test might also save some pilot the embarrassment of having to go out to the airport in the middle of the night to turn off a transmitting ELT.

Just how widespread is this problem of false alarms?

The AFRCC report states, "This year (1992), 1,994 of 2,562 ELT missions (97%) were false." Incidentally, the report noted that the proposed 406 MHz ELT's may eventually help reduce the work load. According to FAA information regarding the ongoing 406 MHz ELT rulemaking process, the proposed 406 MHz ELT's would offer global coverage, better first satellite-pass signal detection, better reliability, better batteries, fewer false alerts, and each ELT will have a personal identifier that is transmitted upon activation that includes the aircraft owner's data as well as aircraft registration and emergency notification data. As proposed, each 406 buyer would register his or

her personal and aircraft information with NOAA's SARSAT Division for later emergency use.

But with all of these benefits for the proposed 406 MHz ELT's, the AFRCC report said it will be years before the high false ELT rate goes down even if the proposed 406 MHz ELT's become widely accepted because the older, less reliable, TSO C91 ELT's will still be in service.

Regardless of the cause, false ELT transmissions could be one of the easiest problems in aviation to eliminate if everyone just would take a few seconds of their time to check their ELT's before leaving their aircraft. Airport operators can also help identify false signals by periodically checking the appropriate frequency on their base station radios. And pilots flying en route should periodically check 121.5 or 243 MHz as appropriate for emergency distress signals. Any pilot receiving an ELT signal should contact ATC immediately. ATC would then take the appropriate action. In some cases, an airborne pilot ELT report may generate a quicker SAR response than if the AFRCC had to wait for a satellite-generated alert. In a real SAR emergency, the time savings might be critical.

According to the 1992 Annual Report, the AFRCC, supporting SAR agencies (local, state, and federal), and volunteer groups such as the Civil Air Patrol (the official Air Force Auxiliary that does the bulk of the Inland SAR missions) all combined to fly 13,131 hours during 6,459 sorties on 2,852 SAR missions in 1992. CAP flew 11,132 of those hours during 5,344 sorties on 2,380 missions. CAP flight time does not include the thousands of ground search hours donated by CAP volunteers. These statistics show the efforts of the many dedicated volunteers and others who are willing to risk their lives on SAR missions each year to help others. Because there is always some risk on any SAR mission for the participants, it is important that they only go out on real missions, not false alarms.

Since 1988, AFRCC has averaged about 7,900 incidents per year.

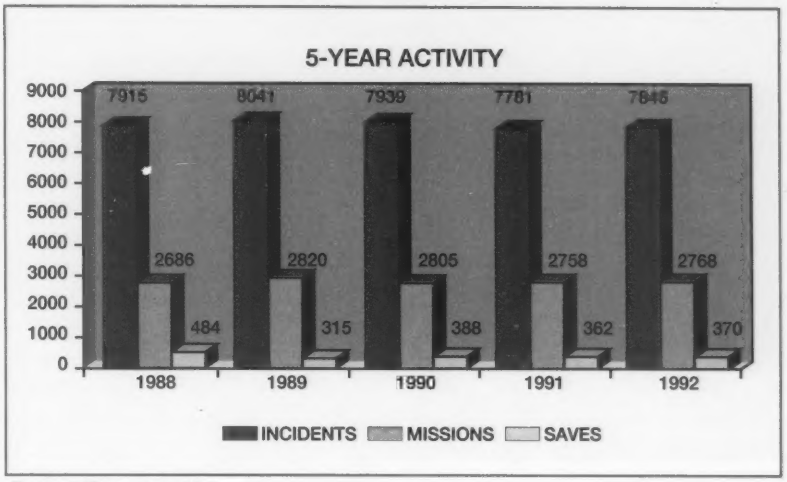


Figure 1 Five-year activity

According to the AFRCC, it responded to 7,846 incidents during 1992. Of that amount, the AFRCC was able to resolve 65% without going to a mission involving other federal agencies. Of the 1,008 people involved in actual distress situations, SAR personnel were credited with saving 370 lives. According to the report, SAR personnel were able to save, assist, or recover 65% of the 1,008 people involved in distress situations. All of us owe a "thank you" to the thousands of dedicated SAR personnel across the country who give their time so others may benefit. This tremendous SAR record is the good news.

The bad news is the continuing problem of finding—or rather not finding—missing aircraft.

FLIGHT PLANS, ETC.

Although the AFRCC is involved in many different kinds of SAR incidents such as missing persons, rescue missions, and aircraft searches, aircraft searches continue to be its least successful type of mission in terms of people saved. The report states, "In 163 aircraft searches, involving 224 persons, only 37 (17%) were saved. Few people survive the type of aircraft crashes we traditionally work at RCC."

How can you help?

It is easy. The report states, "In terms of flying hours and resources used, the most costly missions,

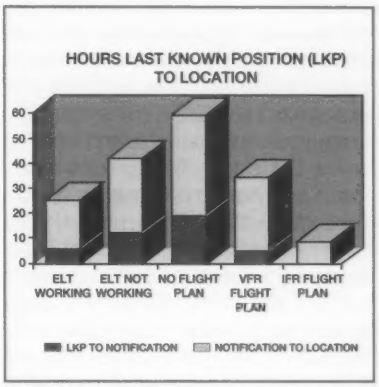


Figure 2 Hours last known position to location

excluding ELT searches, are searches for missing aircraft. In 1992, aircraft searches accounted for only about 6% of our total missions but almost 56% of the total flying hours logged. The reasons for this large investment in flying hours consumed on aircraft searches continue to be:

a. Pilots not filing flight plans

b. Ineffective or inoperative ELT's

c. The intensity of effort required to attain adequate search probabilities of detection in the type terrain aircraft most frequent are lost."

Once again, the annual report states the obvious, "Again this year, the statistics show that on aircraft missions, time from last known position to location is significantly shorter (almost 17 hours on average) for those

incidents where the ELT worked. Filing a flight plan decreased time to location by 48 hours for a VFR flight plan and 63 hours for an IFR plan."

As Figure 1 shows, all pilots can help their own survival chances by filing and activating a flight plan. IFR flight plans are easy. ATC activates and closes the IFR flight plan, and pilots are in contact with ATC throughout their flight. VFR pilots must activate and close their own flight plans; however, for whatever reason many pilots don't bother to file flight plans at all. If you want to increase your survival chances your best insurance policy is to file a flight plan and make periodic position reports.

In addition you should periodically test your ELT in accordance with AIM paragraph 6–15 to make sure it works. If you are in an accident, you should, if able, verify your ELT is transmitting by tuning your radio to 121.5 and listening for the ELT signal. If there is no signal and if you have not been incapacitated, check the ELT antenna to see if it is still attached and pointing in an appropriate direction. Failure to verify your ELT transmission may give you a false sense of hope following an accident which may have destroyed your ELT or failed to activate it. (Some accidents may not generate the right kind of forces needed to activate your ELT.) The only way to know for sure is to monitor the emergency frequency.

It might be a good idea to show your passengers how to check and activate the ELT in your aircraft. If the accident incapacitates you, they may be the only ones able to do the check.

Figures 1 and 2 show some of the annual statistics that might be of interest to those planning their next flight. Remember, the best way to help yourself and save Government resources is by filing a flight plan, flying your plan, and closing your flight plan upon landing. And remember to check your ELT before you secure your aircraft. The time—not to mention the life—you save might be your own.

Remember also to practice FAA Eastern Region's Accident Prevention Program safety slogan, "Accident Free in 93." ■

How to Test Your ELT

(AIM paragraph 6–15)

ELT's should be tested in accordance with the manufacturer's instructions, preferably in a shielded or screened room to prevent the broadcast of signals which could trigger a false alert. When this cannot be done, aircraft operational testing is authorized on 121.5 MHz and 243.0 MHz as follows:

1. Tests should be conducted only during the first five (5) minutes after any hour. If operational tests must be made outside of this timeframe, they should be coordinated with the nearest FAA Control Tower or FSS.
2. Tests should be no longer than three (3) audible sweeps. 3. If the antenna is removable, a dummy load should be substituted during test procedures.
4. *Airborne tests are not authorized*

CHECKING FOR FALSE ALARMS

In addition to the above testing procedure, paragraph 6–15 makes the following suggestions regarding false alarms and in-flight monitoring. It suggests pilots should monitor the emergency frequencies, 121.5 and 243.0 MHz, as follows:

1. In flight when a receiver is available.
2. Before engine shut down at the end of each flight.
3. When the ELT is handled during installation or maintenance.
4. When maintenance is being performed in the vicinity of the ELT.
5. When the aircraft is moved by a ground crew.
6. If an ELT signal is heard, turn off the ELT to determine if it is transmitting. If it has been activated, maintenance might be required before the unit is returned to the "ARMED" position.

If a signal is received in flight, the AIM requests pilots report the following information to the nearest ATC facility:

1. Your position at the time the signal was first heard.
2. Your position at the time the signal was last heard.
3. Your position at maximum signal strength.
4. Your flight altitudes and frequency on which the emergency signal was heard—121.5 or 243.0 MHz. If possible, positions should be given relative to a navigation aid. If the aircraft has homing equipment, provide the bearing to the emergency signal with each reported position.

A Thunderstorm . . .

. . . Unites Just About Every Hazard Known To Aviation!

by the Air Traffic Service

Every year this (and every other) aviation publication includes a pertinent article to focus pilot attention on the upcoming thunderstorm season and to remind pilots of the hazardous weather associated with it. This particular article has been reprinted from an internal air traffic publication aimed primarily at air traffic controllers—the Air Traffic Bulletin. *Indeed, the air traffic service has printed it for so many years, its author's name is lost in the annals of bureaucratic obscurity. Although the article was originally written to help controllers understand the severe atmospheric hazards associated with thunderstorms—so that they can better aid pilots in avoiding them—it also presents factors the pilot must consider when flying in the vicinity of nature's most awesome display of power.* ***—Editor***

JUST HOW POWERFUL ARE THEY?

The latent heat released by a moderate thundercloud is equivalent to the energy of a nuclear explosion of 400 kilotons! Flight through such clouds should be avoided whenever possible, and, although most commercial and many general aviation aircraft are equipped with airborne weather radar, a pilot should always request up-to-date information concerning the location and extent of any active thunderstorm area that may affect his or her flight. Thunderstorms often reach far greater heights than even the usual cruising levels of commercial aviation. The hazards involved in penetrating a thunderstorm are severe turbulence, hail, icing, extreme water ingestion (turbine engines), and, to a lesser degree, lightning.

Downbursts, the strong descending air current found underneath storm clouds, cause rapid variations in wind speed and wind direction near the ground, both of which have proven to be extremely dangerous to low-flying aircraft. Sometimes violent thunderstorms cause the formation of concentrated powerful vortices, extending from the ground well into the cloud, scattered tornadoes or, when over water, waterspouts. Because tornadoes produce the highest wind speeds experienced near the ground (maximum values are estimated at 460 km/h or 285 mph), an aircraft entering a tornado vortex is almost certain to suffer structural damage. Thunderstorm hazards occur simultaneously in numerous combinations. The following discussions examine these and other thunderstorm phenomena.

TORNADOES

The most violent thunderstorms draw air into their cloud bases with great vigor. If the incoming air has any initial rotating motion, it often forms an extremely concentrated vortex from the surface well into the cloud. Meteorologists have estimated that wind in such a vortex can exceed 200 knots, and the pressure inside the vortex is quite low. The strong winds gather dust and debris, and the low pressure generates a funnel-shaped cloud extending downward from the cumulonimbus base. If the cloud does not reach the surface, it is a funnel cloud; if it touches the land surface, it is a tornado; if it touches water, it is a waterspout. Tornadoes have, at times, occurred with isolated thunderstorms, but more frequently they form with steady state thunderstorms associated with cold fronts or squall lines. Reports or forecasts of tornadoes indicate that atmospheric conditions are favorable for violent turbulence. Since the vortex extends well into the cloud, any pilot on instruments inadvertently caught in a severe thunderstorm could encounter a hidden vortex.

Families of tornadoes have been observed as appendages of the main cloud extending several miles outward from the area of lightning and precipitation. Thus, any clouds connected with a severe thunderstorm carry a threat of violence. Frequently cumulonimbus mammatus clouds occur in connection with violent thunderstorms and tornadoes. These clouds display rounded, irregular pockets or festoons from their bases and are a signpost of violent turbulence. Surface aviation observations specifically mention this and other hazardous clouds.

Tornadoes occur most frequently in the Great Plains states east of the Rocky Mountains; however, they have occurred in every state.

SQUALL LINES

A "squall line" is a nonfrontal, narrow band of active, or very active, thunderstorms. They often develop ahead of a cold front in moist, unstable air, but they may develop in unstable air far from any front. The line may be too long to easily detour and too wide and severe to penetrate. They often contain severe steady state thunderstorms and present the single most intense weather hazard to aircraft. They usually form rapidly, generally reaching maximum intensity during late afternoon and the first few hours of darkness.

TURBULENCE

Hazardous turbulence is present in all thunderstorms; in a severe thunderstorm, it can damage an airframe. The strongest turbulence within the cloud occurs with shear between up- and downdrafts. Outside the cloud, shear turbulence has been encountered several thousand feet above and 20 miles laterally from a severe storm. A low level turbulent area is the shear zone between the "plow" wind and the surrounding air. Often, a "roll cloud" on the leading edge of a storm marks the eddies in this shear. The roll cloud is most prevalent with cold front or squall line thunderstorms and signifies an extremely turbulent zone. The first gust causes a rapid and sometimes drastic change in surface wind ahead of an approaching storm.

It is almost impossible to hold a constant altitude in the turbulence associated with a thunderstorm, particularly if you have inadvertently penetrated the storm cloud. Maneuvering, or attempting to do so, greatly increases the stresses on the aircraft. Stresses will be lessened if the aircraft is held in a constant attitude and allowed to "ride the waves." To date, we have no sure way to pick "soft spots" in a thunderstorm.

MICROBURSTS

Microbursts are small-scale, highly intense downdrafts which, upon reaching the surface, spread outward from the downflow center. This causes the presence of both vertical and horizontal wind shear effects that can be extremely hazardous to all types and categories of aircraft, especially at low, critical flight altitudes. Because of their small size, short life-span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems. Parent clouds producing microburst activity can be any of the low or middle layer convective cloud types. Characteristics of microbursts include:

Size—Approximately 6,000 feet in diameter above the ground with a horizontal extent on the surface spreading to approximately 2–1/2 miles outward from the center.

Intensity—Vertical winds as high as 6,000 feet per minute while above the ground, becoming strong horizontal winds with as much as an 80-knot variation when on the surface. The downward airstream may extend as low as tree top level.

Types—In wet areas of the U. S. , microbursts are normally accompanied by heavy rain. However, in dry areas virga is associated with microbursts.

Life—The life-cycle of a microburst from the initial downburst to dissipation will seldom be longer than 10 minutes, with maximum intensity winds lasting approximately two minutes. Multiple microburst activity in the same area is not uncommon and should be expected.

Signs—Dry microbursts often generate a ring of dust on the surface. Opposite direction winds over a short distance, accompanied by cell activity, are also a clear indication of a microburst.

During landing and takeoff, microburst wind shear effects can cause a sufficient reduction in aircraft performance to create a definite possibility of ground contact. Flight in the vicinity of suspected microburst activity should always be avoided.

ICING

Updrafts in a thunderstorm support abundant liquid water. The water becomes supercooled when carried above the freezing level. When temperature in the upward current cools to about –15 degrees Centigrade, much of the remaining water vapor sublimates as ice crystals. Above this level the amount of supercooled water decreases.

Supercooled water freezes on impact with an aircraft. Clear icing can occur at any altitude above the freezing level, but at high levels, icing may be either rime or mixed rime and clear. The abundance of supercooled water makes clear icing occur very rapidly between 0 degrees and –15 degrees Centigrade, and encounters can be frequent in a cluster of cells. Thunderstorm icing can be extremely hazardous.

HAIL

Hail competes with turbulence as the greatest thunderstorm hazard to aircraft. Supercooled drops above the freezing level begin to freeze. Once a drop has frozen, other drops latch on and freeze to it, so the hailstone grows—sometimes into a huge iceball. Large hail occurs with severe thunderstorms that tower to great heights. Eventually the hailstones fall, possibly some distance from the storm core. In fact, hail has been observed in clear air several miles from the parent thunderstorm.

As hailstones fall through the melting level, they begin to melt and precipitation may reach the ground as either hail or rain. Thus, rain at the surface does not mean the absence of hail aloft. You should anticipate possible hail with any thunderstorm, especially beneath the anvil of a large cumulonimbus. Hailstones larger than 1/2-inch in diameter can damage an aircraft in just a few seconds.

LOW CEILING AND VISIBILITY

Visibility generally is near zero within a thunderstorm cloud. Ceilings and visibility can become restricted in precipitation and dust between the cloud base and the ground. These restric-

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tions create the same problem as all ceiling and visibility restrictions, but the hazards are increased manyfold when associated with the other thunderstorm hazards of turbulence, hail, and lightning. In combination, this can make precision instrument flight virtually impossible.

EFFECT ON ALTIMETERS

Pressure usually falls rapidly with the approach of a thunderstorm, then rises sharply with the onset of the first gust and arrival of the cold downdraft and heavy rain showers, falling back to normal as the storm moves on. This cycle of pressure change may occur in 15 minutes. If the altimeter setting is not corrected, the indicated altitude may be in error by over 100 feet.

LIGHTNING

Electricity generated by thunderstorms is rarely a great hazard to aircraft, but it may cause damage and is annoying to flight crews. Lightning is the most spectacular of the electrical discharges associated with thunderstorms.

A lightning strike can puncture the aircraft's skin and can damage communication and electronic navigational equipment. Lightning has been suspected of igniting fuel vapors and causing explosions; however, serious accidents caused by lightning strikes are believed to be extremely rare. Nearby lightning can blind the pilot, rendering one momentarily unable to navigate either by instruments or visual reference. Lightning can also induce permanent errors in the compass. Lightning discharges, even distant ones, disrupt radio communications on low and medium frequencies.

A few pointers on lightning:

- The more frequent the lightning, the more severe the thunderstorm.
- Increasing frequency of lightning indicates a growing thunderstorm.
- Decreasing lightning indicates a storm nearing the dissipating stage.
- At night, frequent distant flashes playing along a large sector of the horizon suggest a probable squall line.

PRECIPITATION STATIC

Precipitation static—a steady, high level of noise in radio receivers—is caused by intense corona discharges from sharp metallic points and edges of flying aircraft. It is encountered often in the vicinity of thunderstorms. When an aircraft flies through clouds, precipitation, or a concentration of solid particles (ice, sand, dust, etc.), it accumulates a charge of static electricity. The electricity discharges onto a nearby surface or into the air causing a noisy disturbance at lower frequencies. The corona discharge is weakly luminous and may be seen at night. Although it has a rather eerie appearance, it is harmless. It was named "St. Elmo's Fire" by Mediterranean sailors, who saw the discharge at the top of ship masts.

ENGINE WATER INGESTION

Turbine engines have a limit on the amount of water they can ingest. Updrafts are present in many thunderstorms, particularly those in the developing stages. If the updraft velocity in the thunderstorm approaches, or exceeds, the terminal velocity of the falling raindrops, very high concentrations of water may occur. It is possible that these concentrations can be in excess of the quantity of water turbine engines are designed to ingest, resulting in flameout or structural failure of one or more engines. Currently, there is no known operational procedure that can completely eliminate the possibility of engine damage or flameout during massive water ingestion. Although the exact mechanism of the water-induced engine stalls has not been determined, it is believed that thrust changes may have an adverse effect on engine stall margins in the presence of massive water ingestion. Avoidance of severe storm systems is the only measure assured to be effective in preventing exposure to this type of multiple engine damage or flameout. During an unavoidable encounter with severe storms, with associated extreme precipitation, the best known recommendation is to follow the severe turbulence penetration procedure contained in the approved airplane flight manual with special emphasis on avoiding thrust changes unless excessive airspeed variations occur.

WEATHER RADAR

Weather radar detects droplets of precipitation by their size. Strength of the radar return (echo) depends on drop size and number. The greater the number of drops, the stronger the echo; and the larger the drops, the stronger the echo. Drop size determines echo intensity to a much greater extent than does drop number. Meteorologists have shown that drop size is almost directly proportional to rainfall rate, and the greatest rainfall rate is in thunderstorms. Therefore, the strongest echoes are thunderstorms. Hailstones usually are covered with a film of water and, therefore, act as huge water droplets giving the strongest of all echoes. Showers show less intense echoes, and gentle rain and snow return the weakest of all echoes.

Since the strongest echoes identify thunderstorms, they also mark the areas of greatest hazard. Radar information can be valuable both from ground-based radar for preflight planning and from airborne radar for severe weather avoidance. Thunderstorms build and dissipate rapidly, and they also may move rapidly. The best use of ground radar information is to isolate general areas and coverage of echoes. Remember that weather radar detects only precipitation drops; it does not detect minute cloud droplets. Therefore, the radar scope provides no assurance of avoiding instrument weather in clouds and fog.

The most intense echoes on weather radar are severe thunderstorms. Since hail may fall several miles from the cloud and hazardous turbulence may extend as much as 20 miles from the cloud, pilots should request separation from the most intense echoes by 20 miles or more.

PIREP's

Since PIREP information may be such a significant factor in both the pilot's and controller's operational deci-

sions, providing and disseminating PIREP information should receive attention. The imminent arrival of thunderstorm season is a good time for pilots and controllers to review and refresh their knowledge of PIREP procedures.

DO'S AND DON'TS OF THUNDERSTORM FLYING

Remember, never regard any thunderstorm as "light" even when radar returns show the echoes are of light intensity. Avoiding thunderstorms is still the best policy. The following are some "Do's and Don'ts" of thunderstorm avoidance:

Don't land or take off in the face of an approaching thunderstorm. A sudden wind shift or low level turbulence could cause loss of control.

Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence under the storm could be disastrous.

Don't try to circumnavigate thunderstorms covering 6/10 of an area or more either visually or by airborne radar.

Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms that are not embedded can usually be visually circumnavigated.

Do avoid, by at least 20 miles, any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.

Do clear the top of a known, or suspected, severe thunderstorm, if possible, by at least 1,000 feet altitude for each 10 knots of wind at the cloud top. This would exceed the altitude capability of most aircraft.

Do remember that vivid and frequent lightning indicates a severe thunderstorm.

Do regard as severe any thunderstorm with tops 35,000 feet, or higher whether the top is visually sighted or determined by radar.

INADVERTENT PENETRATION

If you cannot avoid penetrating a thunderstorm, the following are some "Do's" before entering the storm:

Do tighten your safety belt, put on your shoulder harness if you have one, and secure all loose objects.

Do plan your course to take you through the storm in a minimum time.

Do establish a penetration altitude below the freezing level or above the level of -15 degrees Centigrade, to avoid the most critical icing.

Do turn on pitot heat and carburetor or jet inlet heat. Icing can be rapid at any altitude and cause almost instantaneous power failure or loss of airspeed indication.

Do establish power settings for the turbulence penetration airspeed recommended in your aircraft manual. Reduced airspeed lessens the structural stresses on the aircraft.

Do turn up cockpit lights to highest intensity to lessen the danger of temporary blindness from lightning.

Do disengage the altitude and speed hold modes if using the automatic pilot. The automatic altitude and speed controls will increase maneuvers of the aircraft thus increasing structural stresses.

Do, if using airborne radar, tilt your antenna up and down occasionally. Tilting it up may detect a hail shaft that will reach a point on your course by the time you do. Tilting it down may detect a growing thunderstorm cell that may reach your altitude.

Do keep your eyes on your instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning.

Do maintain a constant attitude; let the aircraft "ride the waves. "Maneuvers in trying to maintain constant altitude increase stresses on the aircraft.

Don't turn back once you are in the thunderstorm. A straight course through the storm will most likely get you out of the hazardous area most quickly. In addition, turning maneuvers increase stresses on the aircraft.

Don't change power settings; maintain settings for reduced airspeed. ■

Medical Stuff

Continued from page 9

Exercise is a very important part of the quitting program. Health spa activities, swimming, walking, hiking, bicycling, and jogging are all excellent forms of exercise that can be used to eliminate the desire to smoke.

The dividends of nonsmoking include greatly diminished risk of emphysema (a crippling lung disease), lung cancer, self-immolation in bed, throat cancer, cardiovascular disease, stroke, aneurysm of the large blood vessels, retinal cell death, and many other serious conditions.

In addition a recent study on the harmful effects of cigarettes smoking on 17,824 U.S. males found that during a five-year period, smokers of 20 or more cigarettes per day developed cataracts at twice the rate of nonsmokers. It is suspected that cigarette smoking changes the nature of the nutrients on which the lens of the eye depends to maintain its transparency. It is also possible that elevated blood carbon monoxide levels may damage the lens of the eye by interfering with the metabolism of the lens cells. Nicotine or the effects of nicotine metabolic products may also injure the lens. Statistics suggest that 20% of cataract cases in the U.S. are attributable to cigarette smoking. As transparency of the lens is an important factor for safe flight, smoking cigarettes is clearly incompatible with piloting aircraft.

There are clear health incentives for pilots to quit smoking, and there are increasingly effective ways to kick the habit successfully. ■

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Soaring and Air Traffic Control Can Work Together

by W. G. Hill

"Say again your type aircraft," said the controller.

"I'm in a sailplane," replied the pilot.

There is a slight pause, and the controller replies, "Roger, squawk four six one three."

The glider pilot responds, "What's a 'squawk'?"

This scenario is, of course, a bit of an exaggeration, and the preponderance of sailplane pilots are professional aviators and, therefore, would know exactly what the controller meant when he or she assigned a transponder code.

There are, however, some things glider pilots don't know about ATC and some things ATC doesn't know about gliders.

What are Sailplanes?

They are majestic creatures of the sky who ply their trade on rising air currents created by natural phenomena such as ridges and mountains and by updrafts created by the convective activity of an unstable air mass.

They are the ultimate in the efficient application of unpowered flight.

Had Mother Nature created a flying machine, it most likely would have been a sailplane.

They leave in their passing not a roar but a whisper. They do nothing to violate the environment in which they fly; indeed, they fly because of the environment not in spite of it.

They have been known to share a thermal with hawks and eagles and other soaring birds. Because they mimic the very motions used by soaring birds to gain altitude, they are not perceived as a threat to the safety of such birds.

Sailplanes are one of the few ways in which we can both commune with nature and enjoy the three dimensional activity we know as flight.

Having said all that, it's not hard to understand why some sailplane pilots may view communicating with ATC as an invasion of privacy.

During the course of the last 20 years the National Airspace System has become "FAR" (pun intended) more involved. We have Airport Radar Service Areas (ARSA) and Terminal Control Areas (TCA) where only Control Zones and Airport Traffic Areas existed before. We will soon have the ABC's of airspace [September 1993]. And, of course, uncontrolled airspace at high altitude is almost non-existent in the eastern two-thirds of the lower 48 states.

The airspace, like the air traffic system and associated airborne equipment, has become a very complicated creature, indeed.

Whither the Glider Pilot?

So where has this left the glider pilot whose wood, glue, and fabric sailplane has metamorphosed into the composite thing of beauty you see on these pages?

If that pilot has any intentions of flying his or her sailplane cross country (and a good many do), then he or she must learn the language of the Air Traffic System. More importantly, glider pilots must learn how to communicate the variable of an aircraft that is virtually *never* in level flight to a group of individuals who deal in the constants of assigned headings and altitudes. Therein lies the dichotomy which must be resolved between Air Traffic Control and the sailplane pilot.

Generally, when a controller queries a pilot regarding altitude and receives a reply, the controller tends to think that the pilot will be maintaining that altitude unless the controller receives information to the contrary. Of course, this exchange of information is the key. The controller must know the right questions to ask, and the glider pilot must know how to respond to those questions properly.

For the most part, pilots fly sailplanes because of the freedom associated with the sport. That freedom also includes the desire not to be bothered with the mechanics of dealing with the air traffic system. Because of this, those pilots who have not been reared on such things as control towers and positive control airspace have little knowledge of how to deal with ATC.

Gliders and ATC Contact

Before attempting contact with an ATC facility, be sure you know your position over some clearly identifiable point on the ground. When you transmit, you should be prepared to provide the following information:

- Your aircraft registration number
- The fact that your aircraft type is "glider"
- Equipment code
- The fact that you are operating VFR
- Your location and altitude
- Your request and a statement of your intentions

You should use your aircraft registration number—not a contest number when communication with the ATC facility. The controllers very definitely know what a "glider" is. They may not know what a "sailplane" is. If you identify yourself as a "sail***plane***," they may think you are flying some sort of powered "air***plane***." If you have a Mode C transponder and no other electronic navigation equipment on board, then your equipment code is "/U"—pronounced "slant uniform."

As you are flying along, the controller may ask you to contact another controller on another frequency. This process is called a "handoff" and in theory is carefully coordinated between the two controllers. If no one answers on the new frequency, then change back to the original frequency and tell the controller you were not able to contact the hand-off controller. When you do contact the new controller, you should be sure to mention:

- That you are a glider
- Your entire registration number
- The fact that you are VFR
- Your current altitude
- Your destination

These procedures are exerpted from the article, "Suggested Radio Procedures for Mode C Gliders Flying in and around TCA's," in the October 1992 issue of Soaring *magazine. The author is John O. Graybill. We will reprint the article in its entirety in a future issue.*

For the approximately 11,000 pilots who are rated in gliders and some other powered aircraft, this doesn't pose too much of a problem. For the other nearly 8,000 pilots who are rated in nothing but a glider, the education process is a bit more convoluted.

Gliders are excluded from many of the transponder and Mode C encoder equipment requirements, including those in the airspace between 10,000 feet and flight level 180, and in certain airspace surrounding large airports. The exclusions were granted, in part, because of the power requirements necessary to run the equipment, and the fact is that a sailplane has no other power source save that of a battery, which may be quite small because of the limited space. Additionally, there is no way to re-charge it in flight. However, hand-held transceiver technology seems well-suited to glider pilots.

A recent issue of *Soaring* magazine (November 1992) had an excellent article on suggested phraseology that could be used by glider pilots who are not also rated in powered aircraft and who plan operations in the vicinity of TCA's. What is important is the vast difference between a glider and all the other air traffic that is likely to communicate with ATC.

Operational Considerations

As a rule, controllers are in the habit of dealing with aircraft that operate under a number of constants that make separation and advisories more viable. The average aircraft on an IFR flight plan, for example, will be maintaining a constant altitude, heading, and airspeed unless the route structure or ATC instructions require a change. On the other hand, a glider or sailplane is virtually never in level flight because it is always ascending or descending.

What transforms a gliding (descending) flight into a soaring (ascending) flight is the ability of the pilot to identify and avail him or herself of atmospheric conditions which have a vertical component exceeding the sink rate of the glider or sailplane. When this occurs, the glider can gain altitude.

The majority of cross-country flights in gliders take place using convective updrafts (thermals), which are often marked by cumulus clouds. For a glider pilot, a cross-country flight is nothing more than an interconnected series of climbs and glides, and those glides must be made to the next source of suspected lift. Rarely do the sources of lift (i.e., clouds) align themselves in an extended straight line which coincides with the point to which the sailplane pilot is attempting to fly. Because of this, the series of climbs and glides associated with cross-country flight in a glider will also be marked with a number of course changes designed to get the glider or sailplane from one lift source to the next. When the glider pilot reaches the next point in space where he or she enters an updraft and initiates a climb, that climb is made by making a series of circles designed to keep the sailplane within the confines of the updraft, which is somewhat cylindrical in shape.

Because the sailplane, and hence the pilot, is in a constant state of flux, it is important that the glider pilot who is in communication with ATC keep the controller appraised of his or her intentions. This is especially true when traffic advisories have been issued.

By the same token, the ATC specialist needs to be aware that the sailplane is either climbing (because it has "stopped" to circle) or is gliding (because it is proceeding on course). If the sailplane is both transponder and encoder equipped (as only a few are), then most of that information is already available to ATC by virtue of the display on the controller's radar scope. But the vast majority of sailplane pilots who are radio-equipped must take on the responsibility of informing ATC of changes.

The bottom line is that of communication: from the controller who has a need to remain aware of the sailplane pilot's intentions and from the sailplane pilot who, when working with ATC, must do the utmost to keep the controller aware of his or her intentions. ■

Mr. Hill is a former ATC specialist from Albuquerque, NM with many years of ATC and sailplane experience.

Wake Turbulence

by the Civil Aviation Authority of the United Kingdom

The following is a reprint of the CAA's General Aviation Safety Sense Leaflet 15. Although its references are to events in the UK and Europe, the information and techniques apply to any general aviation aircraft that shares airspace with its airline big siblings. ***—Editor***

Introduction

Recently there has been a fatal accident and a number of serious incidents in the UK as well as at least two fatal accidents in Europe where light aircraft have been severely upset by wake turbulence generated by much heavier aircraft. [Our British cousins do have a gift for understatement.—Editor] The hazard to light aircraft is most likely at airports where general aviation mixes with airline traffic.

All aircraft generate vortices at the wing tips as a consequence of producing lift. ***The heavier the aircraft and the slower it is flying, the stronger the vortex.***

Vortices generally persist for up to 80 seconds, but in conducive atmospheric conditions, they can last as long as two and a half minutes. They tend not to decay gradually but come to a sudden end.

In simple terms, the lighter the aircraft you are flying, the greater the degree of upset if you encounter a wake vortex. Thus, microlight aircraft [CAA terminology for ultralights] could be vulnerable to the vortices of all other aircraft, including many general aviation aircraft.

Vortex Encounters

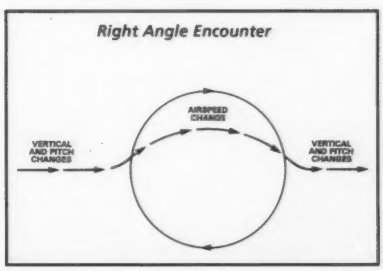
A light aircraft penetrating a vortex from a larger aircraft on the same trajectory and axis can be rolled severely. **For most types it may be beyond the power of the ailerons to counteract fully the roll.**

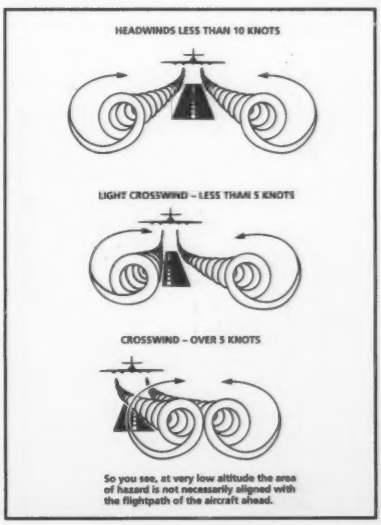
If the vortex is entered at right angles to its axis, rapid vertical and pitch displacements with airspeed changes are likely. An oblique entry, the most likely event, will of course have symptoms of both.

Ground Effect and Atmospheric Conditions

Although a vortex encounter at altitude is uncomfortable and alarming, it is recoverable. Closer to the ground, there may not be room to recover. A significant proportion of the incidents reported in the UK occur below 200 feet, i.e., mainly just before landing but some were shortly after takeoff. This is when the affected aircraft is most likely to be directly behind a larger aircraft.

Vortices generally persist for about 80 seconds close to the ground where their effect is most hazardous. They tend to move apart at about five knots in still air, so a crosswind component of five knots can keep the upwind vortex stationary on or near the runway; the downwind vortex will move away at about 10 knots. In crosswinds of more than 5 knots it can be seen that the area of hazard is not necessarily aligned with the flight path of the aircraft ahead.




HEADWINDS LESS THAN 10 KNOTS
LIGHT CROSSWIND – LESS THAN 5 KNOTS
CROSSWIND – OVER 5 KNOTS
So you see, at very low altitude the area of hazard is not necessarily aligned with the flightpath of the aircraft ahead.

ATC

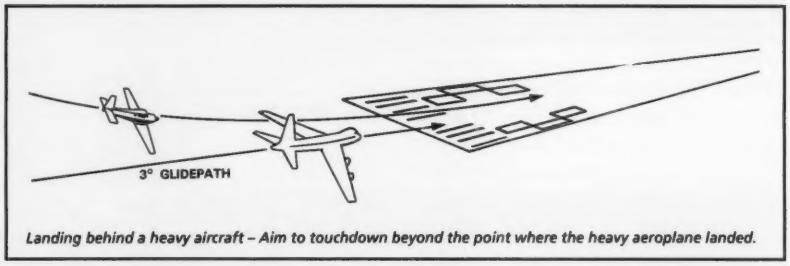
ATC is always provided at UK airports where airliners operate, and the controllers will advise pilots of the necessary interval; e.g., "Golf November Tango, you are number two to a 757. The recommended vortex wake spacing is six miles. Report final." (See the sidebar on page 21 for U.S. procedures.)

For VFR arrivals [in the UK] vortex separation is a pilot responsibility, but the recommended spacing will be given by ATC. If in doubt, ask for a greater spacing.

Vortex Avoidance—Approach

- Since the vortices are invisible (except rarely when the cores can be seen in very humid conditions), they are difficult to avoid. There are two techniques which can be employed:
- Distance can be judged visually by runway length—most major airports have runway lengths between one (6,000 feet) and two (12,000 feet) nautical miles long. Thus, if the recommended spacing is six miles, then you need three to six runway lengths between yourself and the airliner ahead.

If the aircraft on approach ahead of you is much heavier than your own type, try to keep it in sight. In general, vortices drift downwards, so **attempt to fly above** and to the upwind side of the lead aircraft's flight path. Obviously as you get closer to the runway any lateral displacement has to be reduced, so land well up the runway—beyond the point where the heavier aircraft touched down. The generation of vortices stops as the [wheels contact] the runway. The heavier the type ahead, the longer the runway is likely to be, so stopping a light aircraft should not be a problem—it may save you some taxi time! Airliners almost always approach on a 3 glide slope; light aircraft can accept steeper angles without difficulty.



Landing behind a heavy aircraft – Aim to touchdown beyond the point where the heavy aeroplane landed.

Vortex Avoidance—Departure

Vortices start as aircraft rotate on takeoff, so the time interval [in UK air traffic procedures] starts from then. For example, a light aircraft taking off behind a Boeing 737 should allow an interval of at least two minutes if starting from the same point and three minutes if taking off from a point part-way up the same runway.

Vortex Avoidance—General

The simple advice for light aircraft pilots is, "Avoid crossing below or close behind the flight path of a significantly heavier aircraft."

Helicopters

[U.K. procedures] specify minimum spacing between light aircraft and large helicopters. It is thought that helicopters can generate more intense

U.S. Procedures—Helicopters

FAA Airman's Information Manual
Paragraph 7–47:

In a slow hover taxi or stationary hover near the surface, helicopter main rotors generate down wash producing high velocity outwash vortices to a distance approximately three times the diameter of the rotor. When rotor down wash hits the surface, the resulting outwash vortices have behavioral characteristics similar to wing tip vortices produced by fixed aircraft. However, the vortex circulation is outward, upward, around, and away from the main rotors in all directions. Pilots of small aircraft should avoid operating within three rotor diameter of any helicopter in a slow hover taxi or stationary hover.

In forward flight, departing or landing helicopters produce a pair of strong, high-speed trailing vortices similar to wing tip vortices of larger fixed wing aircraft. Pilots of small aircraft should use caution when operating behind or crossing behind landing and departing helicopters.

vortices than a fixed wing aircraft of the same weight. When following helicopters, pilots of light aircraft should consider allowing a larger spacing than would normally be used behind a fixed wing aircraft of similar size.

Helicopters, with rotors turning, create a blast of air outwards in all directions, the strongest effect being downwind. This effect is not so significant when the helicopter with rotors turning is on the ground. It is very severe during hovering and hover taxiing when the rotors are supporting the full weight of the helicopter and this creates the greatest down wash. During your approach it may not be apparent which of the stages the helicopter is at. In these circumstances, pilots of light aircraft should aim to keep as far away as possible. In particular, if there is a helicopter on or near the runway, and if runway length permits, consider landing further down the runway to avoid being caught by rotor wash. If in doubt, make an early decision to go-around.

Summary

- Wake vortices are invisible.
- Vortices last longer and are therefore most hazardous in calm or light wind conditions.
- They are most dangerous close to the ground as there is less recovery room.
- The heavier an aircraft, the stronger its vortex and the greater the risk to following aircraft.
- The lighter the aircraft you are flying the more vulnerable it is.
- On the approach, to avoid vortices, fly above and off-set upwind of the lead aircraft's flightpath.
- Apply the spacing advised by ATC, using runway length as a guide to judging distance.
- Consider allowing a longer gap when following a large helicopter.
- Keep well away from large helicopters with rotors turning, they may be hovering or hover taxiing—it may be difficult to judge. ■

U.S. Air Traffic Wake Turbulence Separations

FAA Airman's Information Manual
Paragraph 7–49:

A. Because of the possible effects of wake turbulence, controllers are required to apply no less than specified minimum separation for aircraft operating behind a **heavy** jet and, in certain instances, behind large **non-heavy** aircraft.

1. Separation is applied to aircraft operating directly behind a **heavy** jet at the same altitude or less than 1,000 feet below:
   (a) **Heavy** jet behind **heavy** jet—4 miles.
   (b) **Small/large** aircraft behind **heavy** jet—5 miles.
2. Also, separation, measured at the time the preceding aircraft is over the landing threshold, is provided to small aircraft:
   (a) **Small** aircraft landing behind **heavy** jet—6 miles.
   (b) **Small** aircraft landing **behind** large aircraft—4 miles.

(Note: See the AIM's Pilot/Controller Glossary for the definition of aircraft classes.)

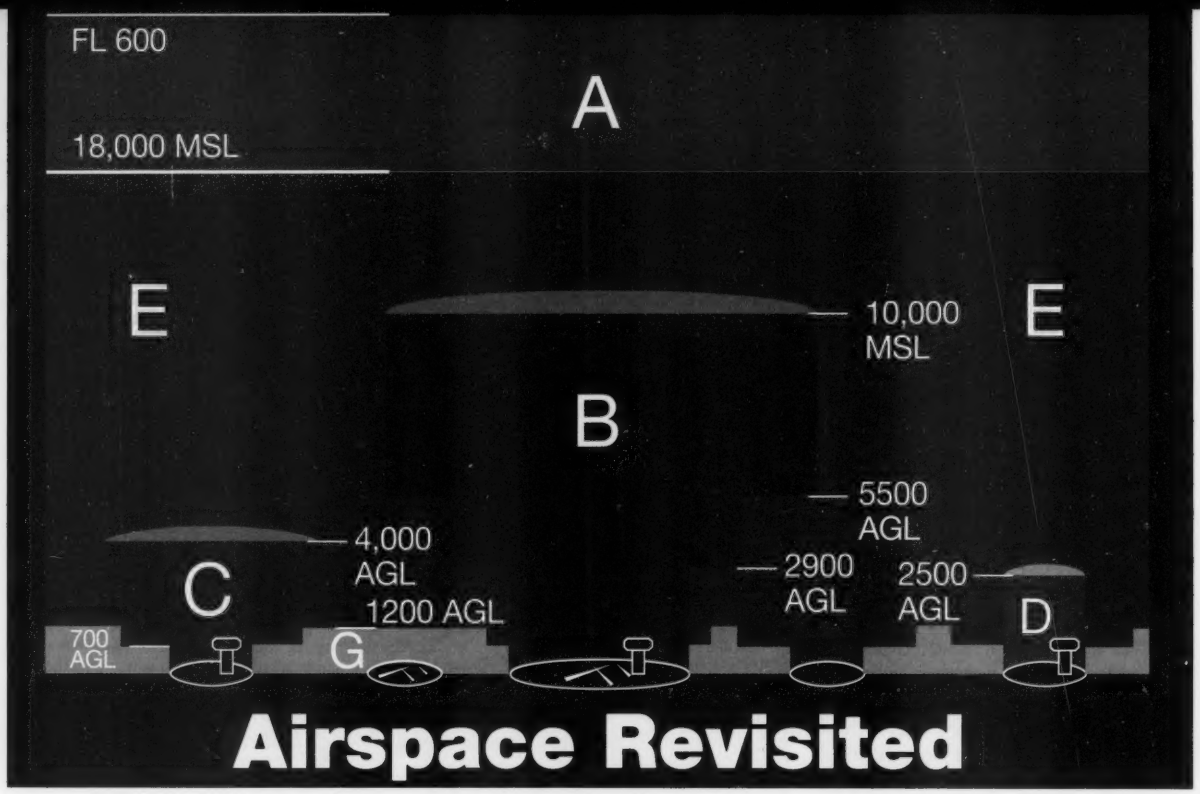
3. Additionally, appropriate time or distance intervals are provided to departing aircraft:
   (a) Two minutes or the appropriate 4 or 5 mile radar separation when takeoff behind a heavy jet will be:
      —From the same threshold
      —On a crossing runway and projected flight paths will cross
      —From the threshold of a parallel runway when staggered ahead of that of the adjacent runway by less than 500 feet and when the runways are separated by less than 2,500 feet.

(Note: Pilots, after considering possible wake turbulence effects, may specifically request waiver of the 2-minute interval by stating, "Request waiver of 2-minute interval" or similar statement. Controllers may acknowledge this statement as pilot acceptance of responsibility for wake turbulence separation and, if traffic permits, issue takeoff clearance.)

   (b) A 3-minute interval will be provided when a **small** aircraft will takeoff:
      —From an intersection on the same runway (same or opposite direction) behind a departing **large** aircraft,
      —In the opposite direction on the same runways behind a large aircraft on takeoff or low/missed approach.

(Note: This 3-minute interval may be waived upon specific pilot request.)

   (c) A 3-minute interval will be provided for all aircraft taking off when the operations are as described in (b) above, when the preceding aircraft is a **heavy** jet, and when the operations are either the same runway or parallel runways separated by less than 2,500 feet. Controllers may not reduce or waive this interval.
   (d) Pilot may request additional separation, i.e., 2 minutes instead of 4 or 5 miles for wake turbulence avoidance. This request should be made as soon as practical on ground control and at least before taxiing onto the runway.
   (e) Controllers may anticipate separation and need not withhold a takeoff clearance for an aircraft departing behind a **large/heavy** aircraft if there is reasonable assurance the required separation will exist when the departing aircraft starts the takeoff roll.



Airspace Revisited

by Louise Oertly, *Associate Editor*

As we get nearer the September 16, 1993 effective date the flying public is beginning to have more questions about what this new system really means to them. At this time it seems appropriate to review just how this reclassification came about and its objectives.

Despite what many people think, the FAA did not arbitrarily adopt the ICAO airspace classification. In 1978 the International Civil Aviation Organization (ICAO) saw the need to study the diverse range of regulations and airspace classifications in use by member states and develop an international standard. Along with such international aviation associations as IAOPA, IFALPA, FAI, IATA, the U.S. as an ICAO member has been among the leaders from the beginning to develop a simplified airspace system.

Paralleling this international effort was our own National Airspace Review (NAR). The FAA published the initial NAR recommendations in 1982 and three initial notices of proposed rulemaking (NPRM) in 1985. The resultant NPRM No. 89–28 was published in the *Federal Register* in October 1989. The NPRM proposed an airspace reclassification. It was not until the following March (1990) that ICAO formally adopted Amendment 33 to Annex 11, Air Traffic Services, which established seven international classes of airspace (A through G). Barely a month after ICAO's November 14, 1991 effective date, FAA's final rule appeared in the December 17 *Federal Register* with an effective date of September 16, 1993.

The airspace reclassification rule established six classes of U.S. airspace, each designated by a letter of the alphabet: A, B, C, D, E, and G. The reason there is no Class F is that the ICAO Class F has no equivalent in U.S. airspace (air traffic control provides separation service to IFR aircraft "so far as practical"). The rule clearly outlined its objectives:

- To simplify the airspace designations.
- To achieve international commonality and satisfy our responsibilities as a member state of ICAO.
- To increase standardization of equipment requirements for operations in various classifications of airspace.
- To describe appropriate pilot certificate requirements, visual flight rules (VFR) visibility and distance from cloud rules, and air traffic services offered in each class of airspace.

This simplification of the airspace will make it easier for pilots to understand the requirements needed to operate in U.S. airspace. In fact, pilots flying IFR will experience very little impact, whereas other pilots will find minimal changes to the operating rules. For example one change permits VFR pilots to remain clear of clouds while operating in Class B (formerly TCA) airspace.

Another way that reclassification will enhance safety and simplify airspace is by eliminating the current difficulty of which requirements apply when several types of airspace overlap around an airport. Within the new airspace reclassification there is a hierarchy; a pilot will know which class takes precedence by simply correlating the class (A, B, C, D, E, and G) of controlled airspace to the airspace surrounding the area—Class A preempts Class B, Class B preempts Class C, etc.

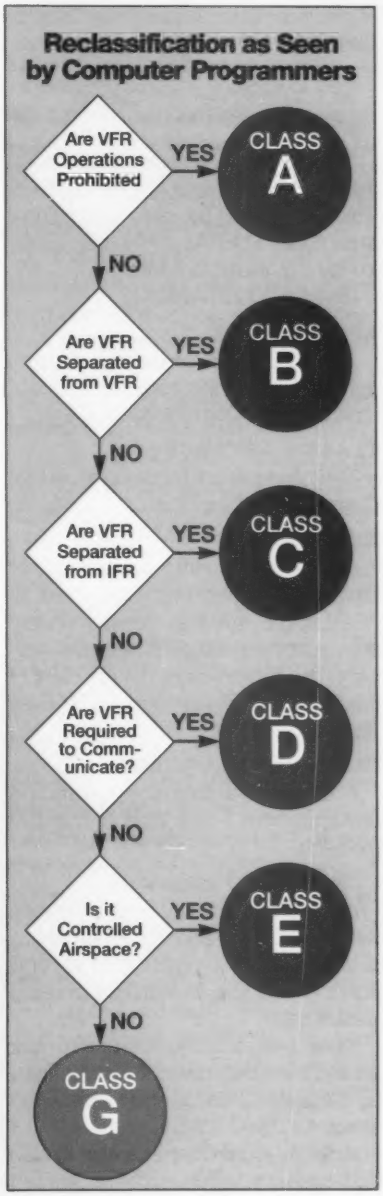
To help clarify some of the questions, comments, or subjects presented by the flying public, the past several issues of the *FAA Aviation News* have featured the "Airspace Corner." The questions have ranged from Airport Traffic Areas to Special VFR to the meaning of surface area (generic replacement for control zones and/or airport traffic area). Another frequent question concerns Terminal Radar Service Areas (TRSA) and what is happening to them. The answer is that they will not become a class of airspace as they do not come under FAR Part 71's definition of controlled airspace nor does the term TRSA appear in FAR Part 91's operating rules. (See "New Terminology for the Pilot/Controller Glossary" in this issue for further description of the TRSA.) The important thing to remember is that they no longer appear on VFR charts in the familiar solid magenta. The new color is solid black. (The color on the chart may vary from black to brown or gray.) The control zone or Class D portion of the TRSA is indicated by a blue segmented line and the remainder of the area overlies other Class E airspace.

The elimination of the Terminal Radar Program that established Stage I, II, and III service is a related and significant change. Basic radar services absorbed Stage I years ago and is now absorbing Stage II services. TCA services replaced Stage III services in the TCA last year and TRSA services are replacing Stage III services in TRSA's. Participating pilots will continue to receive the additional services from TRSA facilities.

To help ease pilots into the new airspace VFR charts began implementing changes last October. The theory is to have all changes in place by the time the new airspace rule goes into effect. By now all the charts have run through their cycle at least once and are now in the process of being fine tuned as errors or conflicts come to light. As with the VFR charts, the IFR charts will also have an insert that explains the new symbology. The only significant IFR chart changes will be going to four colors and deleting the control zones from the charts. [Control zones become part of the Class B (TCA) and Class C (ARSA) surface areas; at towered airports they become Class D; and at nontowered airports they become Class E.] A small boxed [D] next to the airport will be a reminder of a communications requirement should you cancel IFR operations and if the Class D is part-time there will be a star next the boxed [D]*.

For over a year now, the FAA and industry have been educating the flying public about the new airspace system. In meetings with the public one of the most frequent comments regarding the new airspace has been, "It's taken me (you can fill in the number) of years to learn the current system! Why change it now?" It is for this reason alone that the changes were necessary. The FAA believes the simplification of the airspace classifications will reduce existing airspace complexity and thereby enhance safety.

Hopefully, pilots will find it as easy as A, B, C. ■



NEW AIRSPACE TERMINOLOGY IN THE PILOT/CONTROLLER GLOSSARY

Some of the following terms and definitions are new and others have been revised, but after September 16 this phraseology will be used by controllers in reference to the new airspace.

AIRSPACE HIERARCHY

Within the airspace classes, there is a hierarchy and, in the event of an overlap of airspace: Class A preempts Class B, Class B preempts Class C, Class C preempts Class D, Class D preempts Class E, and Class E preempts Class G.

AIRWAY

Class E airspace area established in the form of a corridor, the centerline of which is defined by radio navigational aids. *(See FEDERAL AIRWAYS). (Refer to Part 71). (Refer to AIM).*

(See ICAO term AIRWAY).

AIRWAY [ICAO]

A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

CLASS G AIRSPACE

That airspace not designated as Class A, B, C, D or E.

CLIMB TO VFR

ATC authorization for an aircraft to climb to VFR conditions within Class B, C, D, and E surface areas when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR. (See Special VFR).

CONTROL AREA [ICAO]

A controlled airspace extending upwards from a specified limit above the earth.

CONTROLLED AIRSPACE

An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

Note 1—Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

Note 2—Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in FAR Part 91 (for specific operating requirements, please refer to FAR Part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to FAR Part 71).

Controlled airspace in the United States is designated as follows:

1. CLASS A: Generally, that airspace from 18,000 feet MSL up to and including FL600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.

2. CLASS B: Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."

3. CLASS C: Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C airspace area is individually tailored, the airspace usually consists of a surface area with a 5 nm radius, and an outer area with a 10 nm radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.

4. CLASS D: Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

5. CLASS E: Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or enroute environment, enroute domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Class E airspace does not include the airspace 18,000 MSL or above.

CONTROLLED AIRSPACE [ICAO]

An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Note-Controlled airspace is a generic term that covers ATS airspace Classes A, B, C, D, and E.

OUTER AREA

(associated with Class C airspace)

Nonregulatory airspace surrounding designated Class C airspace airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and participating VFR aircraft. The service provided in the outer area is called Class C service which includes: IFR/IFR-standard IFR separation; IFR/VFR-traffic advisories and conflict resolution; and VFR/VFR-traffic advisories and, as appropriate, safety alerts. The normal radius will be 20 nautical miles with some variations based on site-specific requirements. The outer area extends outward from the primary Class C airspace airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace excluding the Class C charted area and other airspace as appropriate.

(See CONTROLLED AIRSPACE). (See CONFLICT RESOLUTION).

SERVICE

A generic term that designates functions or assistance available from or rendered by air traffic control. For example, Class C service would denote the ATC services provided within a Class C airspace area.

SPECIAL VFR CONDITIONS

Meteorological conditions that are less than those required for basic VFR flight in Class B, C, D, or E surface areas and in which some aircraft are permitted flight under visual flight rules.

(See SPECIAL VFR OPERATIONS). (Refer to FAR 91).

SPECIAL VFR FLIGHT [ICAO]

A VFR flight cleared by air traffic control to operate within Class B, C, D, and E surface areas in meteorological conditions below VMC.

SPECIAL VFR OPERATIONS

Aircraft operating in accordance with clearances within Class B, C, D, and E surface areas in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC.

(See SPECIAL VFR CONDITIONS). (See ICAO term SPECIAL VFR FLIGHT).

SURFACE AREA

The airspace contained by the lateral boundary of the Class B, C, D, or E airspace designated for an airport that begins at the surface and extends upward.

TERMINAL VFR RADAR SERVICE

A national program instituted to extend the terminal radar services provided instrument flight rules (IFR) aircraft to visual flight rules (VFR) aircraft. The program is divided into four types of services referred to as basic radar service, terminal radar service area (TRSA) service, Class B service, and Class C service. The type of service provided at a particular location is contained in the Airport/Facility Directory.

1. Basic Radar Service: These services are provided for VFR aircraft by all commissioned terminal radar facilities. Basic radar service includes safety alerts, traffic advisories, limited radar vectoring when requested by the pilot, and sequencing at locations where procedures have been established for this purpose and/or when covered by a letter of agreement. The purpose of this service is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.

2. TRSA Service: This service provides, in addition to basic radar service, sequencing of all IFR and participating VFR aircraft to the primary airport and separation between all participating VFR aircraft. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the area defined as a TRSA.

3. Class C Service: This service provides, in addition to basic radar service, approved separation between IFR and VFR aircraft, and sequencing of VFR aircraft, and sequencing of VFR arrivals to the primary airport.

4. Class B Service: This service provides, in addition to basic radar service, approved separation of aircraft based on IFR, VFR, and/or weight, and sequencing of VFR arrivals to the primary airport(s).

(See CONTROLLED AIRSPACE). (See TERMINAL RADAR SERVICE AREA).

(Refer to AIM). (Refer to AIRPORT/FACILITY DIRECTORY).

VFR CONDITIONS

Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

1. An IFR aircraft requests a climb/descent in VFR conditions.

2. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

3. A pilot has requested a practice instrument approach and is not on an IFR flight plan. All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in FAR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSA's as required by FAA Order 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

VFR-ON-TOP

ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in FAR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in FAR Part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSA's as required by FAA Order 7110.65.

• Bonding vs. Grounding

In the May/June 1992 issue the article, "Refueling Considerations" makes no mention of bonding, i.e., connecting the fueling apparatus (truck or hydrant, etc.) and aircraft together with a bonding wire. The article mentions "nozzle bonding wire" which seems to imply that the (hopefully) conductive hose completes the bonding path between the fueling apparatus and the aircraft. This is contrary to the requirements of the National Fire Protection Association Bulletin 407. *The bulletin requires a bonding wire between the fueling apparatus and the aircraft, and for overwing fueling, a nozzle bonding wire as well. The bonding wire eliminates the potential difference in electrostatic charges between the two entities.*

An electrostatic charge is created by fuel (a non-conductive fluid) passing through the pipes. However, much more electrostatic charge potential is created by the filter or filter separator. When fuel flows, the negative (or positive) charge migrates to the aircraft and the opposite polarity charge migrates to the filter vessel and thus into the fuel truck vehicle frame. Bonding eliminates the potential difference in charges between the two entities.

An argument against grounding the fuel truck, hydrant, or fuel station and grounding the aircraft is that the ground wires commonly used are far too small. Imagine what would happen if a ground power unit energized by 3 phase/208 volts AC developed a fault, allowing the AC voltage to be applied to the airframe. The aircraft ground wire would probably "melt down" before the AC circuit breaker would trip. As far as lighting strikes are concerned, have you ever noticed the size of the conductor that lighting rod installations use?

According to a Gammon Technical Products newsletter the National Fire Prevention Association's most recent revision of Bulletin 407 *advises that it is safer not to ground, unless it is an adequate ground cable.*

Is this right or wrong?

Thomas E. Miller
Ballston Spa, NY

Thanks for your comments on bonding and grounding. We contacted the National Fire Protection Association's (NFPA) Technical Committee on Aircraft Fueling Service regarding your letter. Mr. Mark T. Conroy, Staff Liaison, NFPA 407, sent us the following letter.

In response to your request for comment regarding the article "Refueling Considerations" in the May/June 1992 issue I offer the following:

***NFPA 407 Standard for Aircraft Fuel Servicing* is the industry standard for aircraft fuel servicing. The purpose of this standard is to provide reasonable minimum fire safety requirements for procedures, equipment, and installations for the protection of persons, aircraft, and other property during ground fuel servicing of aircraft with liquid petroleum fuels. Like all NFPA standards, *NFPA 407* was developed and is revised by a Technical Committee made up of industry volunteers in a consensus process.**

With regard to "hot" fuel servicing of helicopters (engine running and rotors turning), currently *NFPA 407* paragraph 3–5.1 prohibits fuel servicing while an onboard engine is operating. An exception to this provision permits fuel servicing of jet aircraft during an emergency under certain conditions, but this would not apply to helicopters.

A Subcommittee of the NFPA Technical Committee on Helicopter Facilities has been recently appointed to provide recommendations on whether or not hot fuel servicing can safely be accomplished, under what conditions, and on which aircraft. The Subcommittee is still deliberating on the issue. "The jury is still out."

One of the major changes in the 1990 revision of *NFPA 407* was the elimination of the requirement for grounding of aircraft during fuel servicing. Bonding of the fueling equipment to the aircraft by use of a cable prior to making any fueling connection to the aircraft is still required to provide a conductive path to equalize the potential between the fueling equipment and the aircraft.

You may wish to provide your readers with the following explanation which appears in the Appendix (A–3–4) of *NFPA 407*: "Hydrocarbon fuels, such as aviation gasoline and Jet A, generate electrostatic charge when passing through the pumps, filters, and piping of a fuel transfer system. (The primary electrostatic generator is the filter/separator which increases the level of charge on a fuel by a factor of 100 or more as compared with pipe flow.) Splashing, spraying, or free-falling of the fuel will further enhance the charge. When charged fuel arrives at the receiving tank (cargo tank or aircraft fuel tank) either of two possibilities will occur: (1) the charge will relax harmlessly to ground, or (2) if the charge or the fuel is sufficiently high, a spark discharge may occur. Whether or not an ignition will follow will depend on the energy (and duration) of the discharge and the composition of the fuel/air mixture in the vapor space, i.e., whether or not it is in the flammable range.

The amount of charge on a fuel when it arrives at the receiving tank, and hence its tendency to cause a spark discharge, will depend on the nature and amount of impurities in the fuel, its electrical conductivity, the nature of the filter media (if present), and the relaxation time of the system, i.e., the residence time of the fuel in the system between the filter (separator) and the receiving tank. The time required for this charge to dissipate is dependent upon the conductivity of the fuels: it may be a fraction of a second or several minutes.

No amount of bonding or grounding will prevent discharge from occurring inside of a fuel tank. Bonding will ensure that the fueling equipment and the receiving tank (aircraft or fueler) are at the same potential and provide a path for the charges separated in the fuel transfer system (primarily the filter/separator) to combine with and neutralize the charges in the fuel. Also, in overwing fueling and in top loading of cargo tanks, bonding will ensure that the fuel nozzle of the fill pipe is at the same potential as the receiving tank, so that a spark will not occur when the nozzle or fill tank is inserted into the tank opening. For this reason, the bonding wire must be connected before the tank is opened.

Grounding during aircraft fueling or refueler loading is no longer required because:

(1) It will not prevent sparking at the fuel surface (see *NFPA 77, Recommended Practice on Static Electricity*).

(2) It is not required by *NFPA 77, Recommended Practice on Static Electricity.*

(3) The static wire may not be able to conduct the current in the event of an electrical fault in the ground support equipment connected to the aircraft and could constitute an ignition source if the wire fuses. If ground support equipment is connected to the aircraft or if other operations are being conducted that require electrical earthing, then separate connections must be made for this purpose. Static electrical grounding points may have high resistances and therefore are unsuitable for grounding."

For a more complete discussion of static electricity in fuels see *NFPA 77, Recommended Practice on Static Electricity.*

***NFPA 407, Standard for Aircraft Fueling Service* and *NFPA 77, Recommended Practice on Static Electricity* and be ordered from NFPA Customer Service at 1–800–344–3555.**

Thanks for the opportunity to comment on the article.

Mark T. Conroy
Staff Liaison, NFPA 407

FAA AVIATION NEWS welcomes comments from its readers. We may edit letters for style and/or length. We will select one representative letter from those on the same topic for publications, and because of our bimonthly publishing schedule, responses may not appear for several issues. We will send personal replies only upon request. We will not print anonymous letters, but we will withhold names upon request. Address: Editor, FAA AVIATION NEWS, AFS–810, Washington, DC 20591.

Why Would the Aviation Industry be Interested in Training at the FAA Academy?

The FAA's safety team is responsible for almost every area of aviation, which includes surveillance of operations, maintenance, avionics, and manufacturing. The FAA Academy, located in Oklahoma City, OK, is dedicated to these responsibilities. For example, the Airworthiness Branch within the Regulatory Standards and Compliance Division provides resident courses open not only to FAA employees but also to aviation industry personnel as well as foreign joint aviation authorities who rely on guidance and interpretation of the FAR.

The Academy has a complete avionics section that includes the BE-300 Flight Inspection Aircraft Trainer equipped with a complete avionics complement. The training the Academy provides is widely recognized as some of the finest in the industry. Even though technology constantly changes, the students receive training in the most modern systems, enabling students to apply their skills more effectively and efficiently. The Academy provides training in classrooms, laboratories, aircraft simulators, and actual line aircraft. Course designers continuously update materials in order to provide the student with knowledge of the latest regulatory changes.

The FAA Academy plays a key role in assuring the U.S. airspace system, the busiest in the world, continues to be the safest. The Academy is an accredited institution that meets all the standards of the North Central Association of Colleges and Schools. Many courses offer college credit equivalency from the American Council on Education, which is recognized as a major coordinating body for post-secondary education. Instructors are of the highest caliber and are required to meet stringent experience and educational requirements and, as an added bonus, have at their disposal the very latest technology.

A catalog of airworthiness courses, and a listing of course/class dates, and the cost of each course is available upon request from the Airworthiness Branch, Mike Monroney Aeronautical Center, AMA-250, P. O. Box 25082, Oklahoma City, OK 73125; (405) 954–6952.

Our thanks to Patricia Taylor, Contract/Support Clerk, AMA-250, in Oklahoma City for the above information.

FAA CONSUMER HOTLINE
1-800-FAA-SURE
1-800-322-7873

Consumers may call this number if they have problems with services provided by FAA.
Do *NOT* call with complaints about airline service.

Toll free, 8 am to 4 pm Eastern time, Monday-Friday, except holidays.

The Year of the Woman—in Aviation History

Members of the Women Airforce Service Pilots (WASP), who fought to use their aviation abilities during World War II and eventually ferried hundreds of airplanes to combat units, will be honored during this year's Experimental Aircraft Association (EAA) fly-in in Oshkosh, WI. The annual fly-in will be held July 29 through August 4 at Wittman Regional Airport in Oshkosh.

As part of EAA's tribute to significant individuals, groups, activities, and engagements during the 50th Anniversary of World War II (1990–1995), the WASP will be recognized throughout the Convention and at a special evening program at the Convention site's "Theater in the Woods" on Saturday, July 31.

The WASP were established in 1942. Their operations were based on Great Britain's "Air Transport Auxiliary" (ATA), a program that included both men and women who ferried airplanes to bases throughout England. The primary mission of the WASP was to perform flying duties in order to free male pilots for combat missions. The WASP became the first American women to fly military aircraft—testing and ferrying airplanes, towing flying targets, and engaging in other non-combat flying activities.

A tent pavilion near the Convention's "West Ramp" (just south of the FAA tower) will be the focal point for WASP activities during EAA Oshkosh '93. Aircraft representative of those flown by the WASP will be on static display nearby. WASP members will participate in daily seminars at the Pavilion throughout the week.

For additional information contact Dick Knapinski at EAA; (414) 426–4800.

William Kershner, the 1992 CFI of the Year, is shown with his family and FAA Administrator Richards

If You Forgot, Wait 'til Next Year

Nominations for the 1993 Certificated Flight Instructor and Aviation Maintenance Technician of the Year award were due in your local Flight Standards District Office by July 2, 1993. The two national winners will receive awards and honoraria from the FAA and industry at a Washington, DC ceremony in November.

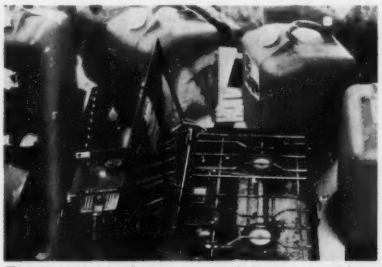
If you can beat the July 2 deadline, contact your local Accident Prevention Program Manager for the nomination forms. If you missed it this year, start thinking about whom you would like to nominate for the 1994 awards.

Hazardous Materials—Tips for Airline Passengers

Some materials can be very dangerous if carried on an aircraft. Hazardous materials include many common items from the home, workshop, or garage which, because of their physical or chemical properties, can pose a danger when transported. The following is a partial list of common items that are hazardous materials forbidden in carry-on and checked luggage:

- Mace, tear gas, and other irritants
- Aerosols containing flammable material
- Loaded firearms
- Gunpowder
- Loose ammunition
- Gasoline, flammables
- Propane, butane cylinders or refills, lighter refills
- Wet-type batteries (e.g., as used in cars)
- Any equipment containing fuel
- Scuba tanks, if pressurized
- Fireworks, flares
- Safety or "strike-anywhere" matches
- Flammable paint and paint-related material
- Corrosive material
- Poisonous material
- Infectious substances
- Radioactive material

Many other hazardous materials are also prohibited. when in doubt, check with your airline. Violator of Federal hazardous materials regulations (49 CFR Parts 171–180) may be subject to a civil penalty of up to $25,000 for each violation and, in appropriate cases, a criminal penalty.



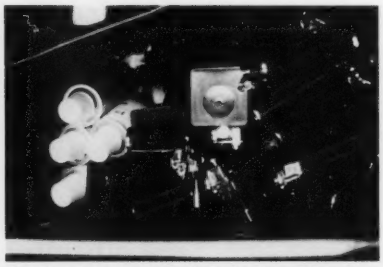
Think twice before you pack boxes and bags for air transport. These fuel containers were found packed in with household goods, and the boxes had no outside markings indicating their volatile contents. Fortunately, neither the fuel for the camping stove or the Avgas exploded during flight.

Remember, hazardous materials are prohibited in checked or carry-on luggage. However, there are certain exceptions for personal care, medical needs, sporting equipment, and items to support physically challenged travelers. For example:

- Toiletry and medicinal articles containing hazardous material (e.g., flammable perfume) totaling no more than 75 ounces may be carried on board. Contents of each container may not exceed 16 fluid ounces or one pound.
- Matches and lighters may only be carried on your person. However, lighters with flammable liquid reservoirs and lighter fluid are forbidden. (Smoking is prohibited on scheduled air carrier flights of six hours or less within the 48 contiguous states and between certain other locations.)
- Carbon dioxide gas cylinders worn by passengers to operate mechanical limbs and spare cylinders of a similar size for the same purpose are permitted in both carry-on and check luggage.
- Carrying firearms on board aircraft is forbidden. Unloaded firearms can be transported in checked luggage if declared to the agent atcheck-in and packed in a suitable container. Check with your airline representative for other restrictions concerning firearms.
- Ammunition may not be carried on board an aircraft. However, small arms ammunition may be transported in checked luggage but must be securely packaged in material designed for that purpose. Amounts may vary depending on the airline. Check with your airline.
- Dry ice for packing perishables, in quantities not to exceed four pounds, may be carried on board an aircraft provided the package permits the release of carbon dioxide. Further restrictions apply to dry ice in checked luggage. Check with your airline.
- Electric wheelchairs may only be transported as checked luggage. The airline may determine that the battery must be dismounted and packed in accordance with airline requirements. Check with your airline representative.

Some items can be shipped as air cargo. Contact your airline representative for detailed instructions regarding the shipment of hazardous materials.

For a pocket-sized leaflet containing the above information contact FAA, APA–200, 800 Independence Ave., S.W., Washington, DC 20591; (202) 267–3479.



Imagine everyone's surprise when this innocent looking bag exploded during handling. It seems that its owner was carrying butane torches used in the dental industry. One shifted during the flight, causing the explosion.

Koch's Komments

The photo that started it all shows the aircraft is about a half turn into a left spin.

In the September/October 1992 issue we published a letter congratulating us on recovering the camera and film from the aircraft because, he said, the aircraft must have crashed. The photograph showed it spinning at an altitude of 110 feet. We thought his comments would generate some interesting feedback, so we printed it.

The pilot flying the aircraft in question wrote to say he did not crash. In fact he is the current manager of the Scottsdale (AZ) Flight Standards District Office (FSDO) and our old boss, Mr. Gary D. Koch, Sr., but many pilots may remember him as the former National Program Manager of the FAA's Accident Prevention Program here in Washington. Here is Gary's description of the flight.

The infamous flight occurred back in 1978 while I was assigned to the Denver GADO (General Aviation District Office) as the APS (Accident Prevention Specialist). I managed to talk our avionics inspector, Al Lundquist, who is a private pilot and a darn good photographer, into going with me to film some "airwork." I kind of soft sold the idea that we would be "spinning." I explained to Al that he would sit in the left seat, with his camera at ready, and using fast shutter technique, capture the instrument readings as we "flopped" around the sky! Al agreed to come along and film this epic.

My goal was to perform a one-turn spin and record exactly how much altitude would be lost during recovery. Also to record the time, in seconds, it took to complete the spin as well as recording altitude, rate-of-descent, and airspeed indications. By the time we got into the spin sequence, Al had figured out he had been duped, and this "airwork" was not quite what he expected. I think Al came close to calling this adventure off and filing a violation of some sort against me!

It took a few takes for Al to adjust to the spinning, as our first pictures turned out showing the rudder pedals, ash trays, and sun visors of the trusty Cessna 150. However, Al hung in and did a great job. After numerous spins, Al captured a good sequence from start to recover. I have used the spin sequence series in numerous spin presentations and the slides have been utilized by the FAA's Accident Prevention Program, the AOPA Air Safety Foundation, and numerous safety related aviation groups.

To put Mr. McLaughlin at ease, we did not crash or burn. We started the spin at 10,200 feet and recovered at 9,500 feet. The best I could do was 500 feet to fully recover from a one-turn spin. The slides turned out well and pointed out that a 500 foot altitude loss could occur in approximately 7–9 seconds and the altitude indicator, turn coordinator, rate-of-climb indicator all do their thing as you plummet to the ground. The safety message here is—if you stall and spin on base to final, or in the traffic pattern, "school's out!" In other words, you could be Bob Hoover or any top notch aerobatic pilot, but if you do not have enough altitude to recover, you are dead!

It was a fun project and Al is still alive and well, doing his avionic thing at the Denver FSDO. I think he has forgiven me for "duping" him into filming some "airwork," but he did a great job of filming and hopefully we have prevented some stall/spin accidents through the presentations. ■

The photographer experiencing post-flight trauma and trying to decide if he could file a violation against the pilot.

The instigator and pilot of the spin photo mission, Gary Koch. Insert, the unsuspecting photographer, Al Lundquist, before the flight.

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